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REVISIONS
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MONTANA DEPARTMENT OF HIGHWAYS

STANDARD DRAWINGS

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1984 Edition

Effective August 1, 1985

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STATE OF MONTANA
DEPARTMENT OF HIGHWAYS

NOTICE CONCERNING REVISIONS TO THE
1984 EDITION OF THE STANDARD DRAWINGS

The following are revised and new drawings, together with revised page 4 of the Table of Contents, to be added to the Standard Drawing Book you now have. These drawings affect those projects let to contract after August 1, 1985.

Std. Dwg. No. 85A - Metal Guardrail
85B - Metal Median Rail
87A - Guardrail Installation for Median Hazards
87B - Guardrail Installation for Median & Outside Shoulder Hazards
88 - Guardrail for Grade Crossing Protection
89A - Guardrail Terminal Sections
89B - Guardrail End Anchorage

Users of these Standard Drawings are advised to examine carefully each drawing. The following are "some" of the more significant changes involved and do not necessarily refer to all changes made on a particular drawing.

Std. Dwgs., Nos. 85A & 85B
A note pertaining to tacking of the blocks was added to each drawing. Dwg. No. 85A also contains changes to the details shown for "Section A-A" and "Bitum. Curb With Guardrail."

Std. Dwgs., Nos. 87A & 87B
These are new drawings and replace current Std. Dwg. No. 87.

Std. Dwg. No. 88
Changes were made in the Terminal Sections called for in the PLAN view. The note in the bottom right hand corner was also revised.

Std. Dwg. No. 89A
This drawing was revised completely. Terminal Section 1 is now only 37.5 feet long using a parabolic curve with a 4 foot offset in lieu of the previous 75.0 feet tangent section with an 8.5 foot offset. Previous Terminal Section A has been deleted. Terminal Section 3 (previous 6) for placement into the cut slope is a complete new design.

Std. Dwg. No. 89B
This drawing was revised completely. Principal design changes were the addition of the detail for the "Guardrail End Anchorage - 5 Ft. Radius" and distinguishing between it and the "Guardrail End Anchorage - Standard." The format was revised for clarity.

D. Budd Williams
for J. V. O'Donnell, Supervisor
Contract Plans Section

JVO'D:DBW:cg:1Z

FENCE AND CATTLE GUARD (cont.)			
Farm Fence	78	6/1/79	81
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Guardrail Installation for Median & Outside Shoulder Hazards	87B	8/1/85	90
Guardrail for Grade Crossing Protection	88	8/1/85	90
Guardrail Terminal Sections	89A	8/1/85	90
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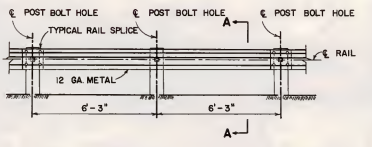
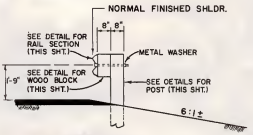
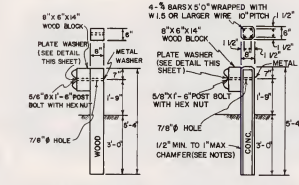
Effective Aug. 1, 1985

2'0" WIDENING IS REQUIRED IF FINISHED ROADWAY WIDTH IS LESS THAN 28'





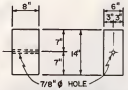
SECTION A-A


8"X 6"X14" WOOD BLOCK
PLATE WASHER (SEE DETAIL THIS SHEET)
METAL WASHER
5/8"Ø X1'-6" POST BOLT WITH HEX NUT
7/8"Ø HOLE
1'-9"
5'-4"
3'-0"
WOOD
4-⅝ BARS X 5'0" WRAPPED WITH W.I.S OR LARGER WIRE 10" PITCH
1 1/2"
6"X6"X14" WOOD BLOCK
1 1/2"
PLATE WASHER (SEE DETAIL THIS SHEET)
METAL WASHER
5/8"X1'-6" POST BOLT WITH HEX NUT
7/8"Ø HOLE
1/2" MIN. TO 1" MAX. CHAMFER(SEE NOTES)
CONC.
DAPPED POST (PERMISSIBLE TO DAP FULL LENG)
8" MIN. DIA.
10" MAX. DIA.
9"X6"X14" WOOD BLOCK
COUNTERSINK BACK OF POST FOR METAL WASHER
PLATE WASHER (SEE DETAILS THIS SHEET)
5/8"Ø X 1'-6" POST BOLT WITH HEX NUT
7/8" Ø HOLE
1" MIN.
DAPPED POST (PERMISSIBLE TO DAP FULL LENG.)

SQUARE WOOD POST (S4S OR ROUGH)

CONCRETE POST

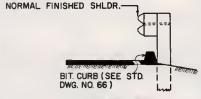
ROUND WOOD POST



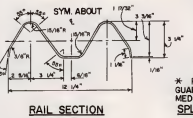
8"X6"X14" WOOD BLOCK (S4S OR ROUGH)

DETAIL OF GUARD RAIL POSTS

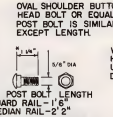
2'0" WIDENING IS REQUIRED IF FINISHED ROADWAY WIDTH IS LESS THAN 28'



BITUM. CURB WITH GUARD RAIL



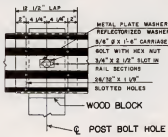
RAIL SECTION


OVAL SHOULDER BUTTON HEAD BOLT OR EQUAL POST BOLT IS SIMILAR EXCEPT LENGTH.
5/8" DIA
* POST BOLT LENGTH GUARD RAIL - 1'6" MEDIAN RAIL - 2'2"

SPLICE BOLT & NUT

WASHER TO BE PLACED BETWEEN HEAD AND RAIL OF POST BOLT, USE ON POST CONNECTIONS THAT DO NOT USE REFLECTORS.

PLATE WASHER DETAIL


12 1/2"
1'-4"
2'-1 1/4"
2'-4 1/4"
METAL PLATE WASHER OR REFLECTORIZED WASHER
5/8" Ø X 1'-6" CARRIAGE BOLT WITH HEX NUT
3/4"X 2 1/2" SLOT IN RAIL SECTIONS
3/4"X 1 1/8" SLOTTED HOLES
WOOD BLOCK
℄ POST BOLT HOLE

RAIL SPLICE DETAIL
(LAP IN DIRECTION OF TRAFFIC)

MATERIAL SIZES

MATERIAL MEETING FORMER STD. DWG. REQUIREMENTS IS ACCEPTABLE PROVIDING IT IS USED ON TOTAL PROJECT.

NOTES

RAIL: GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 525 OR ASTM A 123. STEEL RAIL SHALL CONFORM TO **ASSHTO** M180. ALL RAIL PLATES ARE TO BE LAPPED IN DIRECTION OF TRAFFIC.

POSTS: ROUND POSTS SHALL HAVE NO DIAMETER LESS THAN 8" OR MORE THAN 10" ONLY ONE TYPE POST (SQUARE OR ROUND) TO BE USED WITHIN ONE PROJECT.

TERMINAL SECTIONS: SEE STANDARD DRAWING NO. B9A FOR APPROACH AND DEPARTURE TERMINAL SECTIONS.

BRIDGE APPROACH: SEE STANDARD DRAWING NO. B6 FOR TREATMENT AT BRIDGE ENDS

REFLECTOR-WASHER: ALL SECTIONS OF GUARD RAIL SHALL HAVE REFLECTOR WASHERS SPACED EVERY 25 FT. REFLECTOR WASHERS TO BE INCLUDED IN THE UNIT PRICE PER LINEAR FOOT OF GUARD RAIL. SEE DETAIL ON STANDARD DRAWING NO. B5 B.

FITTINGS: ALL FITTINGS SHALL BE GALVANIZED TO CONFORM WITH STANDARD SPEC. M-220.01

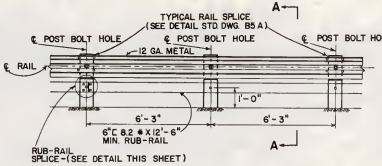
CONCRETE POSTS: ONLY ONE SIZE CHAMFER CAN BE USED IN A SINGLE RUN OF RAIL.

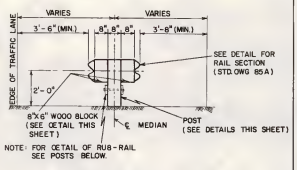
BLOCKS: TO PREVENT TWISTING, BLOCKS SHALL BE AFFIXED TO THE POSTS BY USE OF A NAIL, WIRE, ADHESIVE, OR OTHER MEANS MEETING THE APPROVAL OF THE ENGINEER.

STANDARD DRAWING	
REFERENCE: STANDARD SPEC. SECTION 90	DWG. NO. 85A
METAL GUARD RAIL	

REVISED	NEW	MAY 1985	
EFFECTIVE	4/1/84		

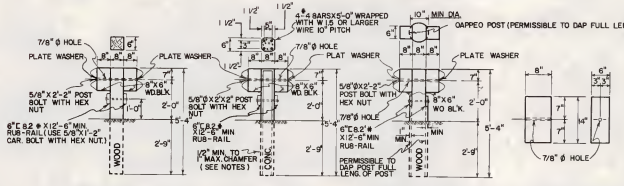
APPROVED BY: Jon M. Hamrick
ADMINISTRATOR-ENGINEERING DIVISION





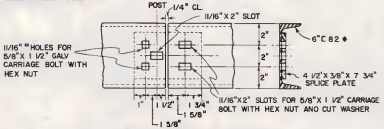
NOTE: FOR DETAIL OF RUB-RAIL SEE POSTS BELOW.

SECTION A-A



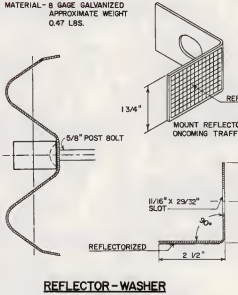
SQUARE WOOD POST (S4S OR ROUGH) | CONCRETE POST | ROUND WOOD POST | WOOD BLOCK DETAIL (S4S OR ROUGH)

DETAIL OF GUARD RAIL POSTS


℄ POST -1/4" CL.
11/16" X 2" SLOT
11/16" HOLES FOR 5/8" X 1 1/2" GALV CARRIAGE BOLT WITH HEX NUT
6"C 8.2 ϕ
2"
2"
2"
4 1/2" X 3/8" X 7 3/4" SPLICE PLATE
11/16"X2" SLOTS FOR 5/8"X 1 1/2" CARRIAGE BOLT WITH HEX NUT AND CUT WASHER
1"
1 1/2"
1 3/4"
5/8"
1 5/8"

DETAIL OF RUB RAIL SPLICE

(RAIL SPLICE TO OCCUR AT POSTS ONLY)



REFLECTOR-WASHER

SEE STANDARD DRAWING NO. 85A

FOR: RAIL SECTION DETAIL
SPLICE BOLT & NUT DETAIL
RAIL SPLICE DETAIL
PLATE WASHER DETAIL

NOTES

RAIL: GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 525 OR ASTM A 123. STEEL RAIL SHALL CONFORM TO AASHTO M180. ALL RAIL PLATES ARE TO BE LAPPED IN DIRECTION OF TRAFFIC.

POSTS: ROUND POSTS SHALL HAVE NO DIAMETER LESS THAN 8" OR MORE THAN 10" ONLY ONE TYPE POST (SQUARE OR ROUND) TO BE USED WITHIN ONE PROJECT.

REFLECTOR-WASHER: ALL SECTIONS OF MEDIAN RAIL SHALL HAVE REFLECTOR WASHERS SPACED EVERY 25 FT. REFLECTOR WASHERS TO BE INCLUDED IN THE UNIT PRICE PER LINEAR FOOT OF MEDIAN RAIL. SEE DETAIL THIS SHEET.

FITTINGS: ALL FITTINGS SHALL BE GALVANIZED TO CONFORM WITH STANDARD SPEC. M - 220.01

CONCRETE POSTS: ONLY ONE SIZE CHAMFER CAN BE USED IN A SINGLE RUN OF RAIL.

BLOCKS: TO PREVENT TWISTING, BLOCKS SHALL BE AFFIXED TO THE POSTS BY USE OF A NAIL, WIRE, ADHESIVE, OR OTHER MEANS MEETING THE APPROVAL OF THE ENGINEER.

MATERIAL SIZES

MATERIAL MEETING FORMER STD. DWG. REQUIREMENTS IS ACCEPTABLE PROVIDING IT IS USED ON TOTAL PROJECT.

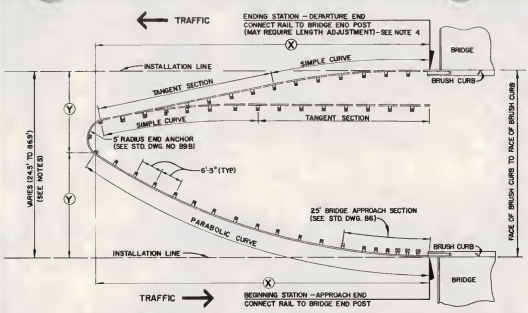
STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90 — DWG. NO. 85 B

METAL MEDIAN RAIL

REVISED	NEW	MAY 1985
EFFECTIVE	4/1/84	8/1/85

APPROVED BY Dan M. Krenzke
ADMINISTRATOR - ENGINEERING DIVISION



(X) IS THE DISTANCE ALONG THE INSTALLATON LINE FROM THE BEGINNING OR ENDING STATION TO A POST LOCATION.

(Y) IS THE OFFSET FROM INSTALLATION LINE TO THE FACE OF RAIL.

APPROACH SIDE OFFSETS
(FACE OF GUARDRAIL)

DATA	STATION	(X)	(Y)
	0	0	0
	3.125	3.125	0.03
	6.25	6.25	0.11
	9.375	9.37	0.24
	12.5	12.49	0.43
	15.625	15.61	0.67
	18.75	18.72	0.96
PARABOLIC (BY SLOPE)	25	24.92	1.71
Δ = 24°50'	31.25	31.10	2.66
L = 84.39'	37.5	37.24	3.82
T1= 41.49'	43.75	43.34	5.17
T2=44.24	50	49.40	8.73
	56.25	55.40	8.48
	62.5	61.34	10.41
	68.75	67.22	12.53
	75	73.03	14.82
	81.25	78.79	17.28
	87.5	84.46	19.89
	93.75	90.13	22.51
	100	95.81	25.14
	106.25	101.48	27.76
TANGENT EXTENSION (SEE PLANS)	112.5	107.15	30.39
	118.75	112.82	33.01
	125	118.49	35.64
	131.25	124.17	38.28
	137.5	129.84	40.89
	143.75	135.51	43.51
	150	141.18	46.13
	156.25	146.85	48.76
	162.5	152.53	51.38

DEPARTURE SIDE OFFSETS
(FACE OF GUARDRAIL)

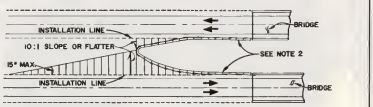
DATA	STATION	(X)	(Y)
NOSE			
Δ = 143°14'30"			
R = 5'			
L = 12.5'			
T = 15.05'			

NOTE:

Refer to plans for tables

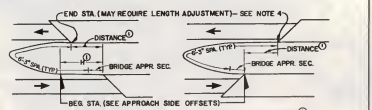
NOTES:

1. SLOPE FLATTENING AND GUARDRAIL LAPPING DETAIL:



2. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.

3. SKEW BRIDGE DETAILS:



(1) IS THE LOWEST MUTIPLE OF 12.5' WHICH EXCEEDS DISTANCE D

4. AN ADDITIONAL TANGENT SECTION OF BEAM GUARDRAIL WILL BE INCLUDED AS THE LOWEST MUTIPLE OF 12.5' WHICH EXCEEDS NET L.N. FT. GUARDRAIL PER INSTALLATIN.

5. THIS DRAWING IS APPLICABLE FOR PROVIDING GUARDRAIL PROTECTION FROM MEDIAN HAZARDS LOCATED BETWEEN INSTALLATION LINES (SEE DETAIL) OF NOT LESS THAN 24.5' NOR MORE THAN 86.9'.

6. WHEN DISTANCE BETWEEN INSTALLATION LINES EXCEEDS 86.9', USE 300' TANGENT SECTION PLUS TERMINAL SECTION NO I (SEE STD. NO. 891A).

7. WHEN DISTANCE BETWEEN INSTALLATION LINES IS NOT LESS THAN 18.75' NOR MORE THAN 24.5', SEE STD. DWG. NO. 871B.

8. WHEN DISTANCE BETWEEN INSTALLATION LINES IS LESS THAN 16.75', SEE PLANS FOR SPECIAL TREATMENT.

9. APPROPRIATE ADJUSTMENT IN DESIGN OF INSTALLATION SHALL BE MADE FOR CURVED ROADWAY, SKEWED BRIDGES, OR OTHER CONDITIONS NOT SHOWN. EXACT DETAILS OF THE INSTALLATION SHALL BE DIRECTED BY THE ENGINEER.

APPLICATION CRITERIA

SEE ABOVE NOTES 5,6,7 & 8

STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90

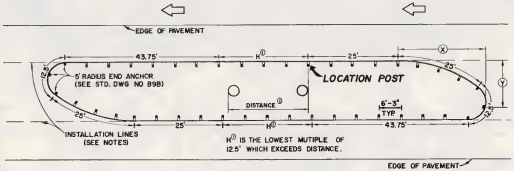
DWG. NO. 87A

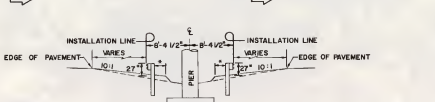
GUARDRAIL INSTALLATION FOR MEDIAN HAZARDS

REVISED	NEW		
EFFECTIVE	8/1/85		

APPROVED BY: [signature] ADMINISTRATOR - ENGINEERING DIVISION

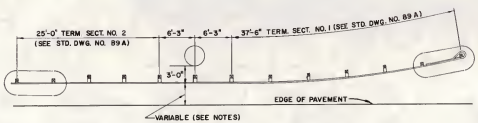
MEDIAN BRIDGE PIER TREATMENT

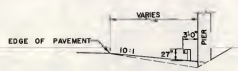




MEDIAN DETAIL

OUTSIDE SHLDR. BRIDGE PIER TREATMENT





OUTSIDE SHOULDER DETAIL

NOTES:

(APPLICABLE TO MEDIAN HAZARDS)

1. APPROACH SIDE OFFSETS MEDIAN BRIDGE PIER TREATMENT:

CURVE DATA	DISTANCE ALONG CURVE	(X)	(Y)
DELTA = 36°45'30" RADIUS = 38.97'	PC	0	0
	6.25	6.24	0.50
	12.5	12.29	1.99
	18.75	18.03	4.42
DELTA=143°14' 30" RADIUS=5'	PCC	25	23.32	7.75
	31.25	25.07	13.33
	PT	37.5	20.33	16.75

(X) IS THE DISTANCE ALONG THE INSTALLATION LINE FROM THE BEGINNING OF GUARDRAIL TO A POST LOCATION.

(Y) IS THE OFFSET FROM INSTALLATION LINE TO FACE OF RAIL.

2. MEDIAN SLOPE FLATTENING AND GUARDRAIL LAPPING DETAIL:

3. THIS DRAWING IS APPLICABLE FOR PROVIDING GUARDRAIL PROTECTION FROM MEDIAN HAZARD LOCATED BETWEEN EDGE OF PAVEMENTS(SEE DETAIL) OF NOT LESS THAN 16'-9" NOR MORE THAN 24'-6".

4. SEE STD. DWG. NO 87A FOR APPLICATIONS NOT MEETING CRITERIA IN NOTE 3.

(APPLICABLE TO OUTSIDE SHOULDER HAZARDS)

5. GUARDRAIL PROTECTION REQUIRED ONLY WHEN NEAREST OBSTRUCTION IS LESS THAN 30 FEET FROM EDGE OF NEAREST TRAFFIC LANE.

(APPLICABLE TO BOTH APPLICATIONS)

6. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.

7. APPROPRIATE ADJUSTMENT IN DESIGN OF INSTALLATION SHALL BE MADE FOR CURVED ROADWAY OR OTHER CONDITIONS NOT SHOWN. EXACT DETAILS OF THE INSTALLATION SHALL BE AS DIRECTED BY ENGINEER.

APPLICATION CRITERIA

SEE ABOVE NOTES 3 & 4

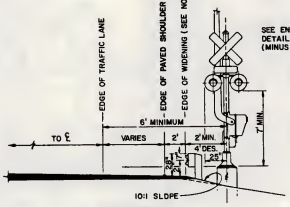
STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90 — DWG. NO. 87B

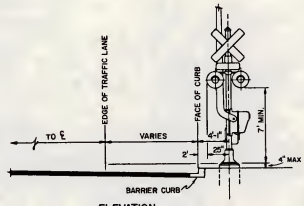
GUARDRAIL INSTALLATION FOR MEDIAN AND OUTSIDE SHOULDER HAZARDS

APPROVED BY: Dale Harcastle, ADMINISTRATOR - ENGINEERING DIVISION

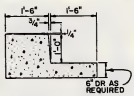
REVISED	NEW		
EFFECTIVE	6-1-82		



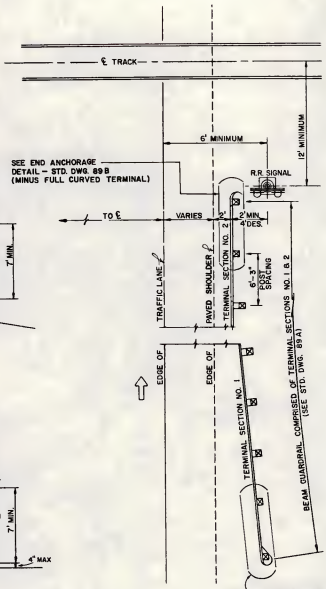
ELEVATION



ELEVATION



TYPICAL BARRIER CURB



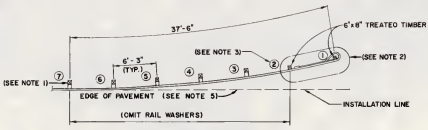
PLAN

SEE 8C-1 OF MANUAL ON UNIFORM TRAFFIC CONTROL FOR ADDITIONAL DETAILS & SKEWED CROSSING.

WIDENING IS NOT REQUIRED IF FINISHED ROADWAY IS MINIMUM 28'.

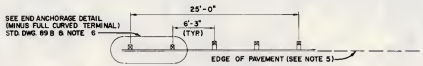
STANDARD DRAWING	
REFERENCE: STANDARD SPEC. SECTION 90	DWG. NO. 88
GUARDRAIL FOR GRADE CROSSING PROTECTION	

REVISED	4/1/79	JUNE 1983	APR. 1985	
EFFECTIVE	6/1/79	4/1/84	8/1/85	BY ADMINISTRATOR-ENGINEERING DIVISION



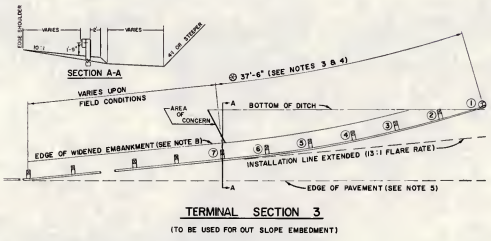
TERMINAL SECTION 1

(TO BE USED ON ALL APPROACH ENDS AND ON ALL TWO LANE, TWO WAY DEPARTURE ENDS)



TERMINAL SECTION 2

(TO BE USED ON FOUR-LANE DIVIDED DEPARTURE ENDS)



TERMINAL SECTION 3

(TO BE USED FOR OUT SLOPE EMBEDMENT)

⑥ PARABOLIC SECTION SHALL NOT BE USED WITHIN THE CLEAR ZONE AS DETERMINED BY AASHTO TRAFFIC BARRIER GUIDE.

SEE PLANS FOR BEGINNING AND ENDING STATIONS OF TERMINAL SECTION.

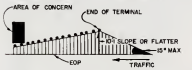
ALL COSTS INVOLVED IN CONSTRUCTING THIS SECTION (INCLUDING BURIED ANCHOR) SHALL BE PAID FOR AT THE UNIT PRICE BID FOR GUARDRAIL.

NOTES:

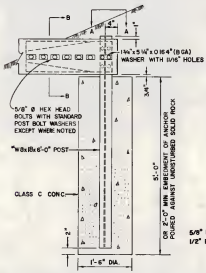
1. 6"x8" POSTS AND BLOCKS (SEE STD.DWG. NO 85A).
2. SEE END ANCHOR DETAIL (STD. DWG. NO. 89B) & NOTE 6.
3. PARABOLIC OFFSET DISTANCES:

POST NO.	⑦	⑥	⑤	④	③	②	①
OFFSET DISTANCE	0.00'	0.11'	0.44'	1.00'	1.78'	2.78'	4.00'

4. BURIED TERMINAL MAY BE OFFSET BY A FLARE RATE OR BY A FLARE RATE + THE 37'-6" PARABOLIC. IF A PARABOLIC IS USED, ALL OFFSETS ARE FROM THE INSTALLATION LINE EXTENDED.
5. IF FINISHED ROADWAY WIDTH IS LESS THAN 26', TWO FEET OF WIDENING IS REQUIRED.
6. NO PLATE WASHERS TO BE INSTALLED BETWEEN RAIL & BOLTHEAD OF POST BOLT ON POSTS 2 THRU 7 OF TERMINAL SECTIONS, EXCEPT ON TERMINAL SECTION NO.2.
7. ROADSIDE SLOPE FLATTENING FOR TERMINAL SECTIONS:



8. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.
9. BURIED GUARD RAIL ANCHOR DETAIL:



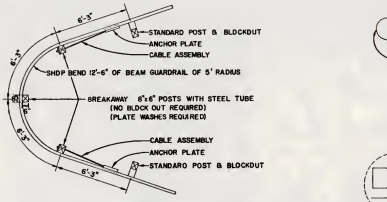
10. TERMINAL RAIL SECTION AND *W8x18 TO BE FABRICATED TO RECEIVE 5/8" HEX HEAD BOLTS AS SHOWN. ALL BOLTS SHALL CONFORM TO ASTM DESIGNATION A 325
* OR NEW W8x18 PER ASTM A6-77b.

STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90 — DWG. NO. 89A

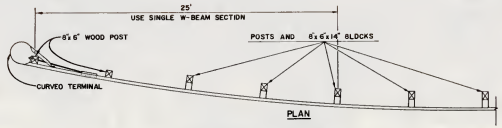
GUARDRAIL
TERMINAL SECTIONS

REVISED	NEW		APPROVED BY: Dan A. Maultsby
EFFECTIVE	8/1/85		ADMINISTRATOR - ENGINEERING DIVISION



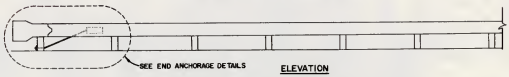
PLAN

(SEE END ANCHORAGE DETAILS)



PLAN

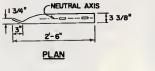
NO PLATE WASHERS TO BE INSTALLED BETWEEN RAIL & BOLT HEAD OF POST BOLT ON FIRST SEVEN POSTS OF TERMINAL SECTION.



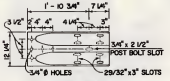
ELEVATION

GUARDRAIL END ANCHORAGE – 5' RADIUS

PAYMENT AT THE UNIT PRICE BID FOR "GUARDRAIL- END ANCHORAGE - 5 FT. RADIUS" SHALL BE FULL COMPENSATION FOR FURNISHING ALL MATERIALS (EXCLUSIVE OF BEAM GUARDRAIL AND POSTS) AND WORK NECESSARY TO CONSTRUCT THE END ANCHORAGE REQUIRED TO COMPLETE THE NOSE SECTION DETAILED HEREON.



PLAN

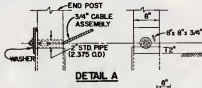


ELEVATION

MICHIGAN END SHOE

(10 GAGE)

HOLES NOT REQUIRED BUT ACCEPTABLE. ONE INCH WASHERS REQUIRED IN CONNECTION OF MICHIGAN END SHOE & TERMINAL ELEMENT.



DETAIL A

WOOD BREAKWAY POST

STEEL TUBE

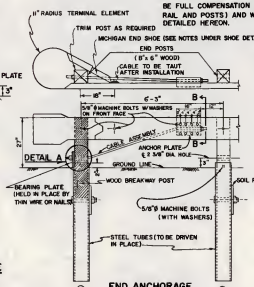
BEARING PLATE DETAILS

NOTES

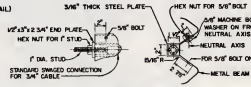
Bolts shall be 1/8" ø smaller than hole and shall be ASTM A-325 or expansion anchor type with washers approved by the Engineer.

GUARDRAIL END ANCHORAGE-STANDARD

PAYMENT AT THE UNIT PRICE BID FOR "GUARDRAIL-END ANCHORAGE- STANDARD" SHALL BE FULL COMPENSATION FOR FURNISHING ALL MATERIALS (EXCLUSIVE OF BEAM GUARDRAIL AND POSTS) AND WORK NECESSARY TO CONSTRUCT EACH END ANCHORAGE AS DETAILED HEREON.



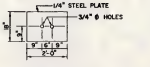
END ANCHORAGE


3/16" THICK STEEL PLATE
HEX NUT FOR 5/8" BOLT
1/2"x3"x 2 3/4" END PLATE
HEX NUT FOR 1" STUD
5/8" BOLT
1" DIA. STUD
STANDARD SWAGED CONNECTION FOR 3/4" CABLE
5/8" MACHINE BOLT AND CUT WASHER ON FRONT FACE AT NEUTRAL AXIS OF RAIL
NEUTRAL AXIS
FOR 5/8" BOLT ON NEUTRAL AXIS
METAL BEAM GUARD RAIL.

SECTION B-B

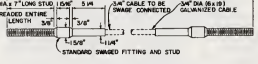
(END PLATE REMOVED)

ANCHOR PLATE DETAILS



SOIL PLATE

END PLATE



STANDARD SWAGED FITTING AND STUD

CABLE ASSEMBLY

STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90

DWG. NO. 898

GUARDRAIL END ANCHORAGE

REVISED	NEW				
EFFECTIVE	8/1/83				

APPROVED BY _____ ADMINISTRATOR - ENGINEERING DIVISION

REVISIONS
To

MONTANA DEPARTMENT OF HIGHWAYS

STANDARD DRAWINGS

1984 Edition

Effective August 1, 1985

STATE OF MONTANA
DEPARTMENT OF HIGHWAYS

NOTICE CONCERNING REVISIONS TO THE
1984 EDITION OF THE STANDARD DRAWINGS

The following are revised and new drawings, together with revised page 4 of the Table of Contents, to be added to the Standard Drawing Book you now have. These drawings affect those projects let to contract after August 1, 1985.

Std. Dwg. No. 85A - Metal Guardrail
85B - Metal Median Rail
87A - Guardrail Installation for Median Hazards
87B - Guardrail Installation for Median & Outside Shoulder Hazards
88 - Guardrail for Grade Crossing Protection
89A - Guardrail Terminal Sections
89B - Guardrail End Anchorage

Users of these Standard Drawings are advised to examine carefully each drawing. The following are "some" of the more significant changes involved and do not necessarily refer to all changes made on a particular drawing.

Std. Dwgs., Nos. 85A & 85B
A note pertaining to tacking of the blocks was added to each drawing. Dwg. No. 85A also contains changes to the details shown for "Section A-A" and "Bitum. Curb With Guardrail."

Std. Dwgs., Nos. 87A & 87B
These are new drawings and replace current Std. Dwg. No. 87.

Std. Dwg. No. 88
Changes were made in the Terminal Sections called for in the PLAN view. The note in the bottom right hand corner was also revised.

Std. Dwg. No. 89A
This drawing was revised completely. Terminal Section 1 is now only 37.5 feet long using a parabolic curve with a 4 foot offset in lieu of the previous 75.0 feet tangent section with an 8.5 foot offset. Previous Terminal Section A has been deleted. Terminal Section 3 (previous 6) for placement into the cut slope is a complete new design.

Std. Dwg. No. 89B
This drawing was revised completely. Principal design changes were the addition of the detail for the "Guardrail End Anchorage - 5 Ft. Radius" and distinguishing between it and the "Guardrail End Anchorage - Standard." The format was revised for clarity.

D Budd Williams
for J. V. O'Donnell, Supervisor
Contract Plans Section

JVO'D:DBW:cg:1Z

FENCE AND CATTLE GUARD (cont.)

Farm Fence	78	6/1/79	81
Cattle Guard	79	4/1/84	82
Precast Concrete Base for Cattleguard	80	6/1/79	82

GUARDRAIL

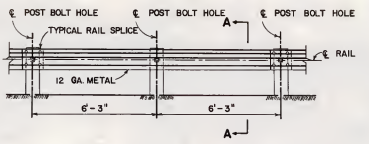
Concrete Median Rail	84	4/1/84	90
Metal Guardrail	85A	8/1/85	90
Metal Median Rail	85B	8/1/85	90
Bridge Approach Sections	86	4/1/84	90
Guardrail Installation for Median Hazards	87A	8/1/85	90
Guardrail Installation for Median & Outside Shoulder Hazards	87B	8/1/85	90
Guardrail for Grade Crossing Protection	88	8/1/85	90
Guardrail Terminal Sections	89A	8/1/85	90
End Anchorage	89B	8/1/85	90
Cable Guardrail	90	3/1/72	90
Cable Guardrail Driveway Anchor Section	91	3/1/72	90

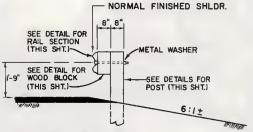
MISCELLANEOUS STANDARDS

Slope Rounding	100	3/1/72	11
Roadway Embankment at Bridge End	101	3/1/72	11
U-Turn Median Openings on Controlled Access Highways	102	3/1/72	11
Approaches	103	3/1/72	20

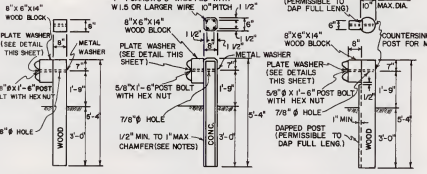
Effective Aug. 1, 1985

2'0" WIDENING IS REQUIRED IF FINISHED ROADWAY WIDTH IS LESS THAN 28'





SECTION A-A



SQUARE WOOD POST (S4S OR ROUGH)

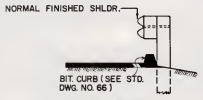
CONCRETE POST

ROUND WOOD POST

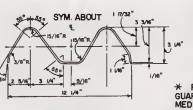
8"X6"X14" WOOD BLOCK (S4S OR ROUGH)

DETAIL OF GUARD RAIL POSTS

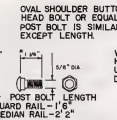
2'0" WIDENING IS REQUIRED IF FINISHED ROADWAY WIDTH IS LESS THAN 28'



BITUM. CURB WITH GUARD RAIL



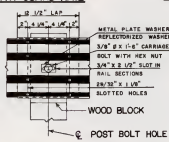
RAIL SECTION


OVAL SHOULDER BUTTON HEAD BOLT OR EQUAL. POST BOLT IS SIMILAR EXCEPT LENGTH.
5/8" DIA
* POST BOLT LENGTH
GUARD RAIL - 1'6"
MEDIAN RAIL - 2'0"

SPLICE BOLT & NUT

WASHER TO BE PLACED BETWEEN HEAD AND RAIL OF POST BOLT. USE ON POST CONNECTIONS THAT DO NOT USE REFLECTORS.

PLATE WASHER DETAIL


12 1/2" LAP
3 1/4" 4 1/4" 4 1/4"
METAL PLATE WASHER OR REFLECTORIZED WASHER
3/8" Ø X 1'-6" CARRIAGE BOLT WITH HEX NUT
3/4" X 2 1/2" SLOT IN RAIL SECTIONS
2¼"30° x 1 1/8" SLOTTED HOLES
WOOD BLOCK
℄ POST BOLT HOLE

RAIL SPLICE DETAIL

(LAP IN DIRECTION OF TRAFFIC)

MATERIAL SIZES

MATERIAL MEETING FORMER STD. DWG. REQUIREMENTS IS ACCEPTABLE PROVIDING IT IS USED ON TOTAL PROJECT.

NOTES

RAIL: GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 525 OR ASTM A 123. STEEL RAIL SHALL CONFORM TO ASSHTO M180 ALL RAIL PLATES ARE TO BE LAPPED IN DIRECTION OF TRAFFIC.

POSTS: ROUND POSTS SHALL HAVE NO DIAMETER LESS THAN 8" OR MORE THAN 10" ONLY ONE TYPE POST (SQUARE OR ROUND) TO BE USED WITHIN ONE PROJECT.

TERMINAL SECTIONS: SEE STANDARD DRAWING NO 89A FOR APPROACH AND DEPARTURE TERMINAL SECTIONS.

BRIDGE APPROACH: SEE STANDARD DRAWING NO. 86 FOR TREATMENT AT BRIDGE ENDS

REFLECTOR-WASHER: ALL SECTIONS OF GUARD RAIL SHALL HAVE REFLECTOR WASHERS SPACED EVERY 25 FT. REFLECTOR WASHERS TO BE INCLUDED IN THE UNIT PRICE PER LINEAR FOOT OF GUARD RAIL. SEE DETAIL ON STANDARD DRAWING NO. 85 B.

FITTINGS: ALL FITTINGS SHALL BE GALVANIZED TO CONFORM WITH STANDARD SPEC. M-220.01

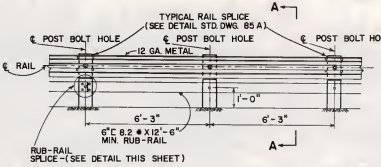
CONCRETE POSTS: ONLY ONE SIZE CHAMFER CAN BE USED IN A SINGLE RUN OF RAIL.

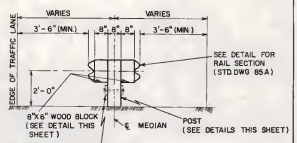
BLOCKS: TO PREVENT TWISTING, BLOCKS SHALL BE AFFIXED TO THE POSTS BY USE OF A NAIL, WIRE, ADHESIVE, OR OTHER MEANS MEETING THE APPROVAL OF THE ENGINEER.

STANDARD DRAWING	
REFERENCE: STANDARD SPEC. SECTION 90	DWG. NO. 85 A
METAL GUARD RAIL	

REVISED	NEW	MAY 1985	
EFFECTIVE	4/1/09		

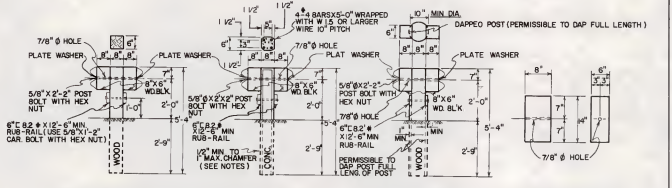
APPROVED BY Dan M. Hauser
ADMINISTRATOR-ENGINEERING DIVISION





NOTE: FOR DETAIL OF RUB-RAIL SEE POSTS BELOW

SECTION A-A



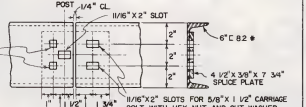
SQUARE WOOD POST (S4S OR ROUGH)

CONCRETE POST

ROUND WOOD POST

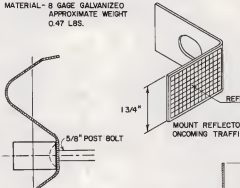
WOOD BLOCK DETAIL (S4S OR ROUGH)

DETAIL OF GUARD RAIL POSTS


℄ POST 1/4" ℄
11/16" X 2" SLOT
11/16" ⌀ HOLES FOR 5/8" X 1 1/2" GALV CARRIAGE BOLT WITH HEX NUT
6"C 8.2 ⌀
2"
2"
2"
4 1/2" X 3/8" X 7 3/4" SPLICE PLATE
1"
1 1/2"
1 3/4"
1 5/8"
11/16" X 2" SLOTS FOR 5/8" X 1 1/2" CARRIAGE BOLT WITH HEX NUT AND CUT WASHER

DETAIL OF RUB RAIL SPLICE

(RAIL SPLICE TO OCCUR AT POSTS ONLY)



REFLECTOR-WASHER

SEE STANDARD DRAWING NO. 85A

FOR: RAIL SECTION DETAIL
SPLICE BOLT & NUT DETAIL
RAIL SPLICE DETAIL
PLATE WASHER DETAIL

NOTES

RAIL: GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 525 OR ASTM A 123. STEEL RAIL SHALL CONFORM TO AASHTO M180. ALL RAIL PLATES ARE TO BE LAPPED IN DIRECTION OF TRAFFIC.

POSTS: ROUND POSTS SHALL HAVE NO DIAMETER LESS THAN 8" OR MORE THAN 10" ONLY ONE TYPE POST (SQUARE OR ROUND) TO BE USED WITHIN ONE PROJECT.

REFLECTOR-WASHER: ALL SECTIONS OF MEDIAN RAIL SHALL HAVE REFLECTOR WASHERS SPACED EVERY 25 FT. REFLECTOR WASHERS TO BE INCLUDED IN THE UNIT PRICE PER LINEAR FOOT OF MEDIAN RAIL. SEE DETAIL THIS SHEET.

FITTINGS: ALL FITTINGS SHALL BE GALVANIZED TO CONFORM WITH STANDARD SPEC. M - 220.01

CONCRETE POSTS: ONLY ONE SIZE CHAMFER CAN BE USED IN A SINGLE RUN OF RAIL.

BLOCKS: TO PREVENT TWISTING, BLOCKS SHALL BE AFFIXED TO THE POSTS BY USE OF A NAIL, WIRE, ADHESIVE, OR OTHER MEANS MEETING THE APPROVAL OF THE ENGINEER.

MATERIAL SIZES

MATERIAL MEETING FORMER STD. DWG. REQUIREMENTS IS ACCEPTABLE PROVIDING IT IS USED ON TOTAL PROJECT.

STANDARD DRAWING

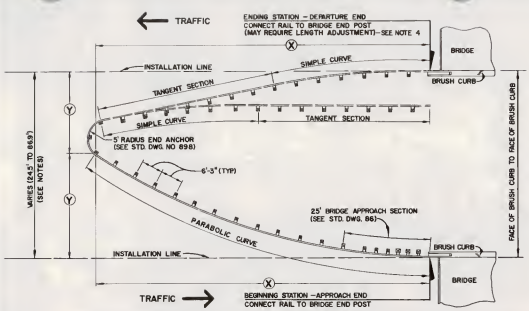
REFERENCE: STANDARD SPEC. SECTION 90

DWG. NO. 85 B

METAL MEDIAN RAIL

REVISED	NEW	MAY 1985
EFFECTIVE	4/1/84	8/1/85

APPROVED
BY Jon M. Kenneth
ADMINISTRATOR - ENGINEERING DIVISION



Ⓧ IS THE DISTANCE ALONG THE INSTALLATON LINE FROM THE BEGINNING OR ENDING STATION TO A POST LOCATION.

Ⓨ IS THE OFFSET FROM INSTALLATION LINE TO THE FACE OF RAIL.

APPROACH SIDE OFFSETS
(FACE OF GUARDRAIL)

DATA	STATION	Ⓧ	Ⓨ
	0	0	0
	3.125	3.125	0.03
	6.25	6.23	0.11
	9.375	9.37	0.24
	12.5	12.49	0.43
	15.625	15.61	0.67
PARABOLIC (BY SLOPE)	16.75	16.72	0.96
Δ = 24°50'	25	24.92	1.71
L = 84.39'	31.25	31.10	2.66
T1= 41.49'	37.5	37.24	3.82
T2=4.424	43.75	43.34	5.17
	50	49.40	6.73
	56.25	55.40	8.48
	62.5	61.34	10.41
	68.75	67.22	12.53
	75	73.03	14.82
	81.25	78.79	17.28
	87.5	84.46	19.89
	93.75	90.13	22.51
	100	95.81	25.14
TANGENT EXTENSION (SEE PLANS)	106.25	101.48	27.76
	112.5	107.15	30.39
	118.75	112.82	33.01
	125	118.49	35.64
	131.25	124.17	38.26
	137.5	129.84	40.89
	143.75	135.51	43.51
	150	141.18	46.13
	156.25	146.85	48.76
	162.5	152.53	51.38

DEPARTURE SIDE OFFSETS
(FACE OF GUARDRAIL)

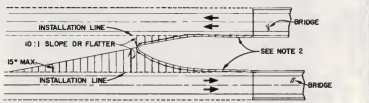
DATA	STATION	Ⓧ	Ⓨ
NOSE			
Δ =143°14'30"			
R = 5'			
L = 12.5'			
T =15.05'			

NOTE:

Refer to plans for tables

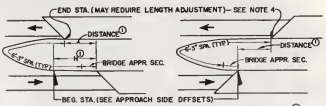
NOTES:

1. SLOPE FLATTENING AND GUARDRAIL LAPPING DETAIL



2. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.

3. SKEW BRIDGE DETAILS:



H (1) IS THE LOWEST MUTIPLE OF 12.5' WHICH EXCEEDS DISTANCE (1)

4. AN ADDITIONAL TANGENT SECTION OF BEAM GUARDRAIL WILL BE INCLUDED AS THE LOWEST MUTIPLE OF 12.5' WHICH EXCEEDS NET LN. FT. GUARDRAIL PER INSTALLATIN.

5. THIS DRAWING IS APPLICABLE FOR PROVIDING GUARDRAIL PROTECTION FROM MEDIAN HAZARDS LOCATED BETWEEN INSTALLATION LINES (SEE DETAIL) OF NOT LESS THAN 24.5' NOR MORE THAN 86.9'.

6. WHEN DISTANCE BETWEEN INSTALLATION LINES EXCEEDS 86.9', USE 300' TANGENT SECTION PLUS TERMINAL SECTION NO 1 (SEE STD. NO. 69 A).

7. WHEN DISTANCE BETWEEN INSTALLATION LINES IS NOT LESS THAN 16.75' NOR MORE THAN 24.5', SEE STD. DWG. NO. 87 B.

8. WHEN DISTANCE BETWEEN INSTALLATION LINES IS LESS THAN 16.75', SEE PLANS FOR SPECIAL TREATMENT.

9. APPROPRIATE ADJUSTMENT IN DESIGN OF INSTALLATION SHALL BE MADE FOR CURVED ROADWAY, SKEWED BRIDGES, OR OTHER CONDITIONS NOT SHOWN. EXACT DETAILS OF THE INSTALLATION SHALL BE DIRECTED BY THE ENGINEER.

APPLICATION CRITERIA

SEE ABOVE NOTES 5,6,7 & 8

STANDARD DRAWING

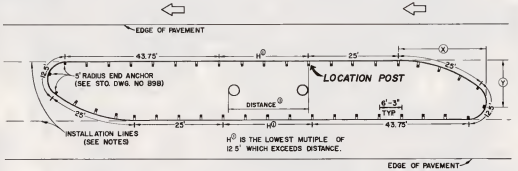
REFERENCE: STANDARD SPEC. SECTION 90.

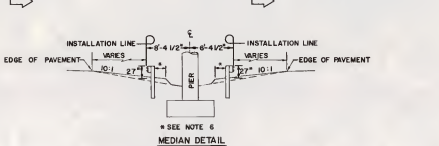
DWG. NO. 87A

GUARDRAIL INSTALLATION FOR MEDIAN HAZARDS

REVISED	NEW		APPROVED BY: Dan M. Abramatic
EFFECTIVE	8/1/85		ADMINISTRATOR - ENGINEERING DIVISION

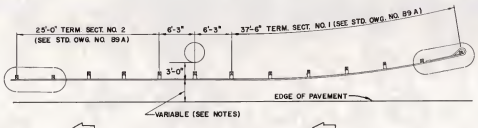
MEDIAN BRIDGE PIER TREATMENT

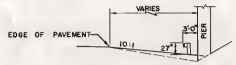




MEDIAN DETAIL

OUTSIDE SHLDR. BRIDGE PIER TREATMENT





OUTSIDE SHOULDER DETAIL

NOTES:

(APPLICABLE TO MEDIAN HAZARDS)

1. APPROACH SIDE OFFSETS MEDIAN BRIDGE PIER TREATMENT:

CURVE DATA	DISTANCE ALONG CURVE		(X)	(Y)
DELTA = 36°45'30" RADIUS = 389'	PC	0	0	0
		6.25	6.24	0.50
		12.5	12.29	1.99
		18.75	18.03	4.42
DELTA=143°14' 30" RADIUS= 5'	PCC	25	23.32	7.75
		31.25	25.07	13.33
	PT	37.5	20.33	16.75

(X) IS THE DISTANCE ALONG THE INSTALLATION LINE FROM THE BEGINNING OF GUARDRAIL TO A POST LOCATION.

(Y) IS THE OFFSET FROM INSTALLATION LINE TO FACE OF RAIL.

2. MEDIAN SLOPE FLATTENING AND GUARDRAIL LAPPING DETAIL:

3. THIS DRAWING IS APPLICABLE FOR PROVIDING GUARDRAIL PROTECTION FROM MEDIAN HAZARD LOCATED BETWEEN EDGE OF PAVEMENTS(SEE DETAIL) OF NOT LESS THAN 16'-9" NOR MORE THAN 24'-6".

4. SEE STD. DWG. NO 87A FOR APPLICATIONS NOT MEETING CRITERIA IN NOTE 3.

(APPLICABLE TO OUTSIDE SHOULDER HAZARDS)

5. GUARDRAIL PROTECTION REQUIRED ONLY WHEN NEAREST OBSTRUCTION IS LESS THAN 30 FEET FROM EDGE OF NEAREST TRAFFIC LANE.

(APPLICABLE TO BOTH APPLICATIONS)

6. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED - SEE PLANS.

7. APPROPRIATE ADJUSTMENT IN DESIGN OF INSTALLATION SHALL BE MADE FOR CURVED ROADWAY OR OTHER CONDITIONS NOT SHOWN. EXACT DETAILS OF THE INSTALLATION SHALL BE AS DIRECTED BY ENGINEER.

APPLICATION CRITERIA

SEE ABOVE NOTES 3 & 4

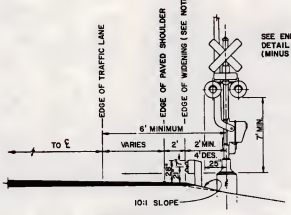
STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90 — DWG. NO. 87B

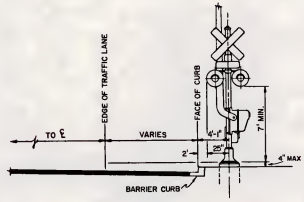
GUARDRAIL INSTALLATION FOR MEDIAN AND OUTSIDE SHOULDER HAZARDS

APPROVED BY: Dale Bartlett
ADMINISTRATOR - ENGINEERING DIVISION

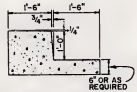
REVISED	NEW		
EFFECTIVE	8-11-87		



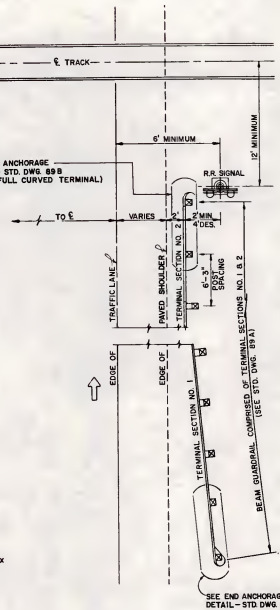
ELEVATION



ELEVATION



TYPICAL BARRIER CURB



PLAN

SEE 8C-1 OF MANUAL ON UNIFORM TRAFFIC CONTROL FOR ADDITIONAL DETAILS & SKEWED CROSSING.

WIDENING IS NOT REQUIRED IF FINISHED ROADWAY IS MINIMUM 26'.

STANDARD DRAWING

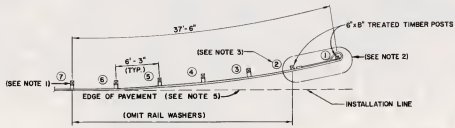
REFERENCE: STANDARD SPEC. SECTION 90

DWG. NO. 88

GUARDRAIL FOR GRADE CROSSING PROTECTION

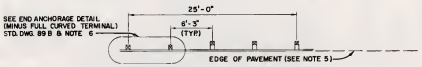
REVISED	4/1/79	JUNE 1983	APR. 1985
EFFECTIVE	6/1/79	4/1/84	9/1/85

BY _____
ADMINISTRATOR – ENGINEERING DIVISION



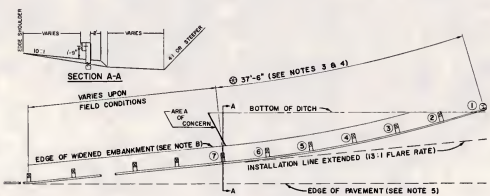
TERMINAL SECTION 1

(TO BE USED ON ALL APPROACH ENDS AND ON ALL TWO LANE, TWO WAY DEPARTURE ENDS)



TERMINAL SECTION 2

(TO BE USED ON FOUR-LANE DIVIDED DEPARTURE ENDS)



TERMINAL SECTION 3

(TO BE USED FOR OUT SLOPE EMBEDMENT)

Ⓟ PARABOLIC SECTION SHALL NOT BE USED WITHIN THE CLEAR ZONE AS DETERMINED BY AASHTO TRAFFIC BARRIER GUIDE.

SEE PLANS FOR BEGINNING AND ENDING STATIONS OF TERMINAL SECTION.

ALL COSTS INVOLVED IN CONSTRUCTING THIS SECTION (INCLUDING BURIED ANCHOR) SHALL BE PAID FOR AT THE UNIT PRICE BID FOR GUARDRAIL.

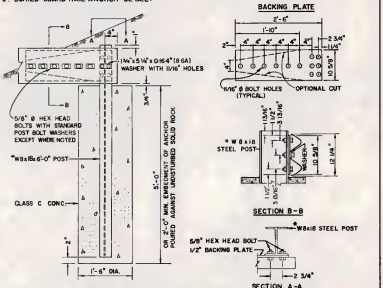
NOTES:

1. 6"x 8" POSTS AND BLOCKS (SEE STD.DWG. NO. 85A).
2. SEE END ANCHOR DETAIL (STD. DWG. NO. 89B) & NOTE 6.
3. PARABOLIC OFFSET DISTANCES:

POST NO.	⑦	⑥	⑤	④	③	②	①
OFFSET DISTANCE	0.00'	0.11'	0.44'	1.00'	1.78'	2.78'	4.00'

4. BURIED TERMINAL MAY BE OFFSET BY A FLARE RATE OR BY A FLARE RATE + THE 37'-6" PARABOLIC. IF A PARABOLIC IS USED, ALL OFFSETS ARE FROM THE INSTALLATION LINE EXTENDED.
5. IF FINISHED ROADWAY WIDTH IS LESS THAN 28', TWO FEET OF WIDENING IS REQUIRED.
6. NO PLATE WASHERS TO BE INSTALLED BETWEEN RAIL & BOLTHEAD OF POST BOLT ON POSTS 2 THRU 7 OF TERMINAL SECTIONS, EXCEPT ON TERMINAL SECTION NO.2.
7. ROADSIDE SLOPE FLATTENING FOR TERMINAL SECTIONS:

8. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.
9. BURIED GUARD RAIL ANCHOR DETAIL:



10. TERMINAL RAIL SECTION AND *W8x18 TO BE FABRICATED TO RECEIVE 5/8" HEX HEAD BOLTS AS SHOWN. ALL BOLTS SHALL CONFORM TO ASTM DESIGNATION A 325
* OR NEW W8x18 PER ASTM A6-77b.

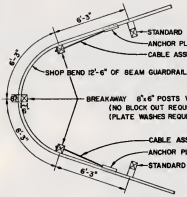
STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90 — DWG. NO. 89A

GUARDRAIL
TERMINAL SECTIONS

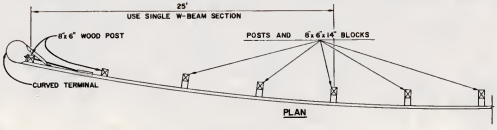
REVISED	NEW			
EFFECTIVE	8/1/85			

APPROVED BY: Dan M. Lawrence
ADMINISTRATOR - ENGINEERING DIVISION



PLAN

(SEE END ANCHORAGE DETAILS)

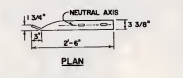


PLAN

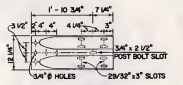
NO PLATE WASHERS TO BE INSTALLED BETWEEN RAIL & BOLT HEAD OF POST BOLT ON FIRST SEVEN POSTS OF TERMINAL SECTION.

GUARDRAIL END ANCHORAGE – 5' RADIUS

PAYMENT AT THE UNIT PRICE BID FOR "GUARDRAIL-END ANCHORAGE - 5 FT. RADIUS" SHALL BE FULL COMPENSATION FOR FURNISHING ALL MATERIALS (EXCLUSIVE OF BEAM GUARDRAIL AND POSTS) AND WORK NECESSARY TO CONSTRUCT THE END ANCHORAGE REQUIRED TO COMPLETE THE NOSE SECTION DETAILED HEREON.



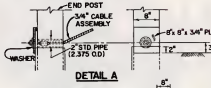
PLAN



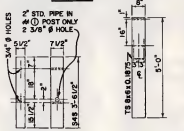
ELEVATION

MICHIGAN END SHOE
(10 GAGE)

□ HOLES NOT REQUIRED BUT ACCEPTABLE. ONE INCH WASHERS REQUIRED IN CONNECTION OF MICHIGAN END SHOE & TERMINAL ELEMENT.



DETAIL A

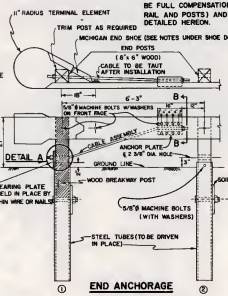


WOOD BREAKWAY POST

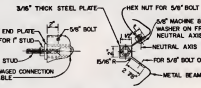
STEEL TUBE

GUARDRAIL END ANCHORAGE-STANDARD

PAYMENT AT THE UNIT PRICE BID FOR "GUARDRAIL-END ANCHORAGE - STANDARD" SHALL BE FULL COMPENSATION FOR FURNISHING ALL MATERIALS (EXCLUSIVE OF BEAM GUARDRAIL AND POSTS) AND WORK NECESSARY TO CONSTRUCT EACH END ANCHORAGE AS DETAILED HEREON.


12" RADIUS TERMINAL ELEMENT
TRIM POST AS REQUIRED
MICHIGAN END SHOE (SEE NOTES UNDER SHOE DETAIL)
END POSTS (6"x 6" WOOD)
CABLE TO BE TAUT AFTER INSTALLATION
6'-3"
B
3/4" Ø MACHINE BOLTS W/WASHERS ON FRONT FACE
6'-3"
B
CABLE ASSEMBLY
ANCHOR PLATE (2 3/4" DIA. HOLE)
GROUND LINE
WOOD BREAKWAY POST
SOIL PLATE
BEARING PLATE (HELD IN PLACE BY THIN WIRE OR NAILS)
5/8" Ø MACHINE BOLTS (WITH WASHERS)
STEEL TUBES (TO BE DRIVEN IN PLACE)
1
2

END ANCHORAGE

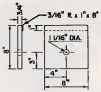

3/16" THICK STEEL PLATE
HEX NUT FOR 5/8" BOLT
5/8" MACHINE BOLT AND CUT WASHER ON FRONT FACE AT NEUTRAL AXIS OF RAIL
NEUTRAL AXIS
FOR 5/8" BOLT ON NEUTRAL AXIS
METAL BEAM GUARD RAIL
1/2"x 3"x 2 3/4" END PLATE
HEX NUT FOR 1" STUD
5/8" BOLT
1" DIA. STUD
STANDARD SWAGED CONNECTION FOR 3/4" CABLE

SECTION B-B
(END PLATE REMOVED)

ANCHOR PLATE DETAILS

SOIL PLATE

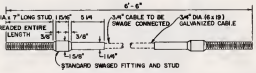
END PLATE



BEARING PLATE DETAILS

NOTES

Bolts shall be 1/8" Ø smaller than hole and shall be ASTM A-325 or expansion anchor type with washers approved by the Engineer.



CABLE ASSEMBLY

STANDARD DRAWING	
REFERENCE: STANDARD SPEC. SECTION 910	DWG. NO. 898

GUARDRAIL
END ANCHORAGE

REVISED	NEW
EFFECTIVE	8-1-85

APPROVED
BY
ADMINISTRATOR - ENGINEERING DIVISION

REVISIONS
To

MONTANA DEPARTMENT OF HIGHWAYS

STANDARD DRAWINGS

1984 Edition

Effective August 1, 1985

STATE OF MONTANA
DEPARTMENT OF HIGHWAYS

NOTICE CONCERNING REVISIONS TO THE
1984 EDITION OF THE STANDARD DRAWINGS

The following are revised and new drawings, together with revised page 4 of the Table of Contents, to be added to the Standard Drawing Book you now have. These drawings affect those projects let to contract after August 1, 1985.

Std. Dwg. No. 85A - Metal Guardrail
85B - Metal Median Rail
87A - Guardrail Installation for Median Hazards
87B - Guardrail Installation for Median & Outside Shoulder Hazards
88 - Guardrail for Grade Crossing Protection
89A - Guardrail Terminal Sections
89B - Guardrail End Anchorage

Users of these Standard Drawings are advised to examine carefully each drawing. The following are "some" of the more significant changes involved and do not necessarily refer to all changes made on a particular drawing.

Std. Dwgs., Nos. 85A & 85B
A note pertaining to tacking of the blocks was added to each drawing. Dwg. No. 85A also contains changes to the details shown for "Section A-A" and "Bitum. Curb With Guardrail."

Std. Dwgs., Nos. 87A & 87B
These are new drawings and replace current Std. Dwg. No. 87.

Std. Dwg. No. 88
Changes were made in the Terminal Sections called for in the PLAN view. The note in the bottom right hand corner was also revised.

Std. Dwg. No. 89A
This drawing was revised completely. Terminal Section 1 is now only 37.5 feet long using a parabolic curve with a 4 foot offset in lieu of the previous 75.0 feet tangent section with an 8.5 foot offset. Previous Terminal Section A has been deleted. Terminal Section 3 (previous 6) for placement into the cut slope is a complete new design.

Std. Dwg. No. 89B
This drawing was revised completely. Principal design changes were the addition of the detail for the "Guardrail End Anchorage - 5 Ft. Radius" and distinguishing between it and the "Guardrail End Anchorage - Standard." The format was revised for clarity.

D. Budd Williams
for J. V. O'Donnell, Supervisor
Contract Plans Section

JVO'D:DBW:cg:1Z

FENCE AND CATTLE GUARD (cont.)			
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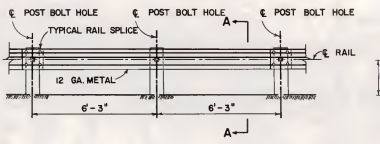
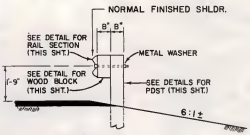
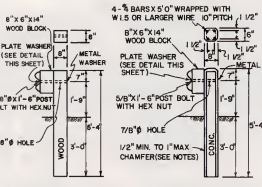
Effective Aug. 1, 1985



2'0" WIDENING IS REQUIRED IF FINISHED ROADWAY WIDTH IS LESS THAN 28'



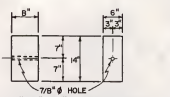
SECTION A-A


6"X 6"X14" WOOD BLOCK
PLATE WASHER (SEE DETAIL THIS SHEET)
METAL WASHER
5/8"Ø X1'-6" POST BOLT WITH HEX NUT
7/8"Ø HOLE
WOOD
1'-9"
3'-0"
4-⅝" BARS X 5'0" WRAPPED WITH W1.5 OR LARGER WIRE 10" PITCH
1/2"
8"X 6"X 14" WOOD BLOCK
PLATE WASHER (SEE DETAIL THIS SHEET)
5/8"X 1'-6" POST BOLT WITH HEX NUT
7/8" Ø HOLE
1/2" MIN. TO 1" MAX CHAMFER (SEE NOTES)
CONC.
DAPPED POST (PERMISSIBLE TO DAP FULL LENG.)
8" MIN. DIA. 10" MAX. DIA.
8"X6"X14" WOOD BLOCK
COUNTERSINK BACK OF POST FOR METAL WASHER
PLATE WASHER (SEE DETAILS THIS SHEET)
5/8"Ø X 1'-6" POST BOLT WITH HEX NUT
7/8" Ø HOLE
1" MIN.
DAPPED POST (PERMISSIBLE TO DAP FULL LENG.)
WOOD
1'-9"
3'-0"

SQUARE WOOD POST (S4S OR ROUGH)

CONCRETE POST

ROUND WOOD POST

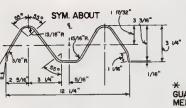


8"X6"X14" WOOD BLOCK (S4S OR ROUGH)

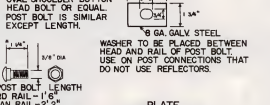
DETAIL OF GUARD RAIL POSTS

2'0" WIDENING IS REQUIRED IF FINISHED ROADWAY WIDTH IS LESS THAN 28'

BITUM. CURB WITH GUARD RAIL

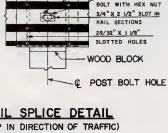


RAIL SECTION


OVAL SHOULDER BUTTON HEAD BOLT OR EQUAL. POST BOLT IS SIMILAR EXCEPT LENGTH.
3"
1 3/4"
8 GA. GALV. STEEL
WASHER TO BE PLACED BETWEEN HEAD AND RAIL OF POST BOLT. USE ON POST CONNECTIONS THAT DO NOT USE REFLECTORS.
* POST BOLT LENGTH
GUARD RAIL- 1'6"
MEDIAN RAIL- 2'2"
3/8" DIA

SPLICE BOLT & NUT

PLATE WASHER DETAIL


12 1/2" LAP
METAL PLATE WASHER OR REFLECTORIZED WASHER
5/8" Ø X 1'-6" CARRIAGE BOLT WITH HEX NUT
3/4" X 2 1/2" SLOT IN RAIL SECTIONS
25/32" X 1 1/8" SLOTTED HOLES
WOOD BLOCK
℄ POST BOLT HOLE

RAIL SPLICE DETAIL

(LAP IN DIRECTION OF TRAFFIC)

MATERIAL SIZES

MATERIAL MEETING FORMER STD. DWG. REQUIREMENTS IS ACCEPTABLE PROVIDING IT IS USED ON TOTAL PROJECT.

NOTES

RAIL: GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 525 OR ASTM A 123. STEEL RAIL SHALL CONFORM TO ASSHTO M180 ALL RAIL PLATES ARE TO BE LAPPED IN DIRECTION OF TRAFFIC.

POSTS: ROUND POSTS SHALL HAVE NO DIAMETER LESS THAN 8" OR MORE THAN 10" ONLY ONE TYPE POST (SQUARE OR ROUND) TO BE USED WITHIN ONE PROJECT.

TERMINAL SECTIONS: SEE STANDARD DRAWING NO B9.A FOR APPROACH AND DEPARTURE TERMINAL SECTIONS.

BRIDGE APPROACH: SEE STANDARD DRAWING NO. 86 FOR TREATMENT AT BRIDGE ENDS

REFLECTOR-WASHER: ALL SECTIONS OF GUARD RAIL SHALL HAVE REFLECTOR WASHERS SPACED EVERY 25 FT. REFLECTOR WASHERS TO BE INCLUDED IN THE UNIT PRICE PER LINEAR FOOT OF GUARD RAIL. SEE DETAIL ON STANDARD DRAWING NO. 85 B.

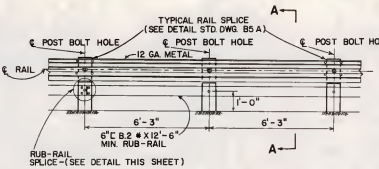
FITTINGS: ALL FITTINGS SHALL BE GALVANIZED TO CONFORM WITH STANDARD SPEC. M-220(1)

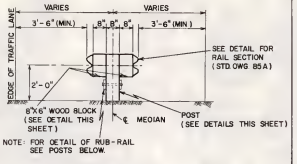
CONCRETE POSTS: ONLY ONE SIZE CHAMFER CAN BE USED IN A SINGLE RUN OF RAIL.

BLOCKS: TO PREVENT TWISTING, BLOCKS SHALL BE AFFIXED TO THE POSTS BY USE OF A NAIL, WIRE, ADHESIVE, OR OTHER MEANS MEETING THE APPROVAL OF THE ENGINEER.

STANDARD DRAWING	
REFERENCE: STANDARD SPEC. SECTION 90	DWG. NO. 85 A
METAL GUARD RAIL	

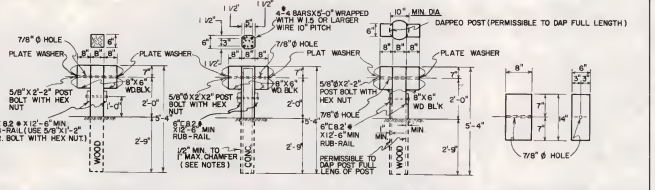
REVISED	NEW	MAY 1985		APPROVED BY: Jon M. Hauenstein
EFFECTIVE	4/1/04			ADMINISTRATOR-ENGINEERING DIVISION





NOTE: FOR DETAIL OF RUB-RAIL SEE POSTS BELOW.

SECTION A-A


7/8" ⌀ HOLE
PLATE WASHER
5/8"⌀ X 2'-2" POST BOLT WITH HEX NUT
6"C B.2 ⊕ X 12'-6" MIN. RUB-RAIL (USE 5/8"X1'-2" CAR. BOLT WITH HEX NUT)
8"X6" WD.BLK.
2'-0"
5'-4"
2'-9"
ROCK
1 1/2"
4-#4 BARS X5'-0" WRAPPED WITH W 1.5 OR LARGER WIRE 10" PITCH
5/8"⌀ X2'X2" POST BOLT WITH HEX NUT
6"C B.2 ⊕ X 12'-6" MIN RUB-RAIL
1/2" MIN. TO 1" MAX. CHAMFER (SEE NOTES)
7/8"⌀ HOLE
PLAT WASHER
5/8"⌀X2'-2" POST BOLT WITH HEX NUT
PERMISSIBLE TO DAP POST FULL LENG OF POST
10" MIN DIA.
DAPPED POST (PERMISSIBLE TO DAP FULL LENGTH)
8"X6" WD BLK
7/8" ⌀ HOLE

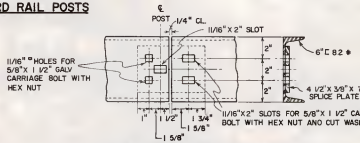
SQUARE WOOD POST (S4S OR ROUGH)

CONCRETE POST

ROUND WOOD POST

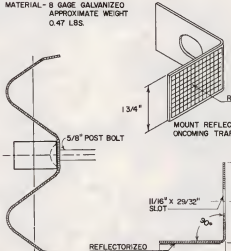
WOOD BLOCK DETAIL (S4S OR ROUGH)

DETAIL OF GUARD RAIL POSTS


℄ POST
1/4" CL.
11/16" X 2" SLOT
11/16" "HOLES FOR 5/8"X 1 1/2" GALV CARRIAGE BOLT WITH HEX NUT
6"C B2 ⊕
4 1/2"X 5/8" X 7 3/4" SPLICE PLATE
11/16"X2" SLOTS FOR 5/8"X 1 1/2" CARRIAGE BOLT WITH HEX NUT AND CUT WASHER
5/8"

DETAIL OF RUB RAIL SPLICE

(RAIL SPLICE TO OCCUR AT POSTS ONLY)



REFLECTOR-WASHER

SEE STANDARD DRAWING NO. 85A

FOR: RAIL SECTION DETAIL
SPLICE BOLT & NUT DETAIL
RAIL SPLICE DETAIL
PLATE WASHER DETAIL

NOTES

RAIL: GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 525 OR ASTM A 123. STEEL RAIL SHALL CONFORM TO AASHTO M180. ALL RAIL PLATES ARE TO BE LAPPED IN DIRECTION OF TRAFFIC.

POSTS: ROUND POSTS SHALL HAVE NO DIAMETER LESS THAN 8" OR MORE THAN 10" ONLY ONE TYPE POST (SQUARE OR ROUND) TO BE USED WITHIN ONE PROJECT.

REFLECTOR-WASHER: ALL SECTIONS OF MEDIAN RAIL SHALL HAVE REFLECTOR WASHERS SPACED EVERY 25 FT. REFLECTOR WASHERS TO BE INCLUDED IN THE UNIT PRICE PER LINEAR FOOT OF MEDIAN RAIL SEE DETAIL THIS SHEET.

FITTINGS: ALL FITTINGS SHALL BE GALVANIZED TO CONFORM WITH STANDARD SPEC. M - 220.01

CONCRETE POSTS: ONLY ONE SIZE CHAMFER CAN BE USED IN A SINGLE RUN OF RAIL.

BLOCKS: TO PREVENT TWISTING, BLOCKS SHALL BE AFFIXED TO THE POSTS BY USE OF A NAIL, WIRE, ADHESIVE, OR OTHER MEANS MEETING THE APPROVAL OF THE ENGINEER.

MATERIAL SIZES

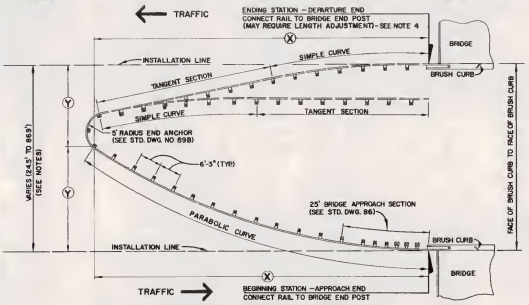
MATERIAL MEETING FORMER STD. DWG. REQUIREMENTS IS ACCEPTABLE PROVIDING IT IS USED ON TOTAL PROJECT.

STANDARD DRAWING	
REFERENCE: STANDARD SPEC. SECTION 90	DWG. NO. 85 B

METAL MEDIAN RAIL

REVISED	NEW	MAY 1985
EFFECTIVE	4/1/84	8/11/85

APPROVED BY Jon M. Nemeth
ADMINISTRATOR-ENGINEERING DIVISION



Ⓧ IS THE DISTANCE ALONG THE INSTALLATON LINE FROM THE BEGINNING OR ENDING STATION TO A POST LOCATION.

Ⓨ IS THE OFFSET FROM INSTALLATION LINE TO THE FACE OF RAIL.

APPROACH SIDE OFFSETS
(FACE OF GUARDRAIL)

DATA	STATION	Ⓧ	Ⓨ
	0	0	0
	3.125	3.125	0.03
	6.25	6.25	0.11
	9.375	9.37	0.24
	12.5	12.49	0.43
	15.625	15.61	0.67
PARABOLIC (BY SLOPE)	18.75	18.72	0.96
Δ = 24°50'	25	24.92	1.71
L = 84.39'	31.25	31.10	2.66
T = 41.49'	37.5	37.24	3.82
T2 = 44.24	43.75	43.34	5.17
	50	49.40	8.73
	56.25	55.40	8.48
	62.5	61.34	10.41
	68.75	67.22	12.53
	75	73.03	14.82
	81.25	78.79	17.28
	87.5	84.46	19.89
	93.75	90.13	22.51
	100	95.81	25.14
TANGENT EXTENSION (SEE PLANS)	106.25	101.48	27.76
	112.5	107.15	30.39
	118.75	112.82	33.01
	125	118.43	35.64
	131.25	124.17	38.26
	137.5	129.84	40.89
	143.75	135.51	43.51
	150	141.18	46.13
	156.25	146.85	48.76
	162.5	152.53	51.38

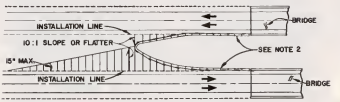
DEPARTURE SIDE OFFSETS
(FACE OF GUARDRAIL)

DATA	STATION	Ⓧ	Ⓨ
NOSE Δ = 143°14'30" R = 5' L = 12.5' T = 15.05'			

NOTE:
Refer to plans for tables

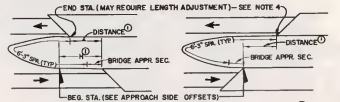
NOTES:

1. SLOPE FLATTENING AND GUARDRAIL LAPPING DETAIL:



2. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.

3. SKEW BRIDGE DETAILS:


END STA. (MAY REQUIRE LENGTH ADJUSTMENT) – SEE NOTE 4
DISTANCE Ⓓ
BRIDGE APPR. SEC.
6'-3" SPA. (TYP.)
DISTANCE Ⓓ
BRIDGE APPR. SEC.
6'-3" SPA. (TYP.)
BEG. STA. (SEE APPROACH SIDE OFFSETS)

Ⓓ IS THE LOWEST MUTIPLE OF 12.5' WHICH EXCEEDS DISTANCE ①

4. AN ADDITIONAL TANGENT SECTION OF BEAM GUARDRAIL WILL BE INCLUDED AS THE LOWEST MUTIPLE OF 12.5' WHICH EXCEEDS NET LN. FT. GUARDRAIL PER INSTALLATIN.

5. THIS DRAWING IS APPLICABLE FOR PROVIDING GUARDRAIL PROTECTION FROM MEDIAN HAZARDS LOCATED BETWEEN INSTALLATION LINES (SEE DETAIL) OF NOT LESS THAN 24.5' NOR MORE THAN 86.9'.

6. WHEN DISTANCE BETWEEN INSTALLATION LINES EXCEEDS 86.9', USE 300' TANGENT SECTION PLUS TERMINAL SECTION NO I (SEE STD. NO. 89 A).

7. WHEN DISTANCE BETWEEN INSTALLATION LINES IS NOT LESS THAN 16.75' NOR MORE THAN 24.5', SEE STD. DWG. NO. 87 B.

8. WHEN DISTANCE BETWEEN INSTALLATION LINES IS LESS THAN 16.75', SEE PLANS FOR SPECIAL TREATMENT.

9. APPROPRIATE ADJUSTMENT IN DESIGN OF INSTALLATION SHALL BE MADE FOR CURVED ROADWAY, SKEWED BRIDGES, OR OTHER CONDITIONS NOT SHOWN. EXACT DETAILS OF THE INSTALLATION SHALL BE DIRECTED BY THE ENGINEER.

APPLICATION CRITERIA

SEE ABOVE NOTES 5,6,7 & 8

STANDARD DRAWING

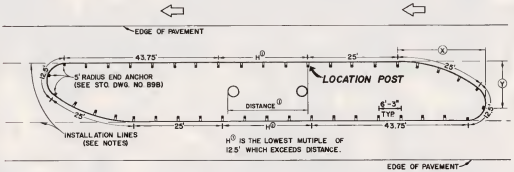
REFERENCE:	DWG. NO.
STANDARD SPEC. SECTION 9.0	87A

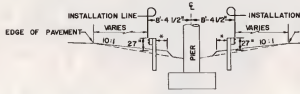
GUARDRAIL INSTALLATION FOR MEDIAN HAZARDS

REVISED	NEW			
EFFECTIVE	8/1/85			

APPROVED BY: Dan M. Hamrick
ADMINISTRATOR - ENGINEERING DIVISION

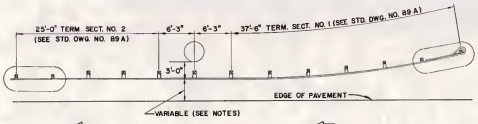
MEDIAN BRIDGE PIER TREATMENT





MEDIAN DETAIL

OUTSIDE SHLDR. BRIDGE PIER TREATMENT



OUTSIDE SHOULDER DETAIL

NOTES:

(APPLICABLE TO MEDIAN HAZARDS)

1. APPROACH SIDE OFFSETS MEDIAN BRIDGE PIER TREATMENT:

CURVE DATA	DISTANCE ALONG CURVE		Ⓧ	Ⓨ
DELTA = 36°45'30" RADIUS = 38.97'	PC	0	0	0
		6.25	6.24	0.50
		12.5	12.29	1.99
		18.75	18.03	4.42
DELTA=14°31'4 30" RADIUS=5'	PCC	25	23.32	7.75
		31.25	25.07	13.33
	PT	37.5	20.33	16.75

Ⓧ IS THE DISTANCE ALONG THE INSTALLATION LINE FROM THE BEGINNING OF GUARDRAIL TO A POST LOCATION.

Ⓨ IS THE OFFSET FROM INSTALLATION LINE TO FACE OF RAIL.

2. MEDIAN SLOPE FLATTENING AND GUARDRAIL LAPPING DETAIL:

3. THIS DRAWING IS APPLICABLE FOR PROVIDING GUARDRAIL PROTECTION FROM MEDIAN HAZARD LOCATED BETWEEN EDGE OF PAVEMENTS(SEE DETAIL) OF NOT LESS THAN 16'-9" NOR MORE THAN 24'-6".

4. SEE STD. DWG. NO. 87A FOR APPLICATIONS NOT MEETING CRITERIA IN NOTE 3.

(APPLICABLE TO OUTSIDE SHOULDER HAZARDS)

5. GUARDRAIL PROTECTION REQUIRED ONLY WHEN NEAREST OBSTRUCTION IS LESS THAN 30 FEET FROM EDGE OF NEAREST TRAFFIC LANE.

(APPLICABLE TO BOTH APPLICATIONS)

6. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.

7. APPROPRIATE ADJUSTMENT IN DESIGN OF INSTALLATION SHALL BE MADE FOR CURVED ROADWAY OR OTHER CONDITIONS NOT SHOWN. EXACT DETAILS OF THE INSTALLATION SHALL BE AS DIRECTED BY ENGINEER.

APPLICATION CRITERIA

SEE ABOVE NOTES 3 & 4

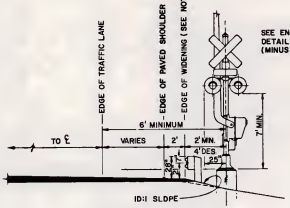
STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90 — DWG. NO. 87B

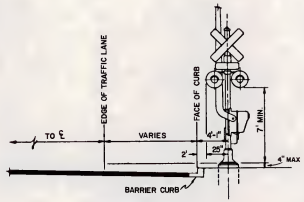
GUARDRAIL INSTALLATION FOR MEDIAN AND OUTSIDE SHOULDER HAZARDS

APPROVED BY _____ ADMINISTRATOR - ENGINEERING DIVISION

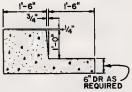
REVISED	NEW		
EFFECTIVE	8-1-89		



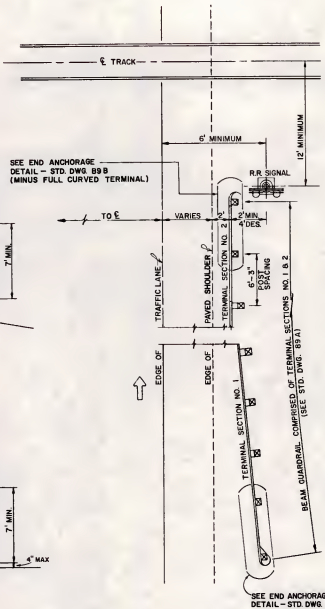
ELEVATION



ELEVATION



TYPICAL BARRIER CURB



PLAN

SEE 8C-1 OF MANUAL ON UNIFORM TRAFFIC CONTROL FOR ADDITIONAL DETAILS & SKEWED CROSSING.

WIDENING IS NOT REQUIRED IF FINISHED ROADWAY IS MINIMUM 28'.

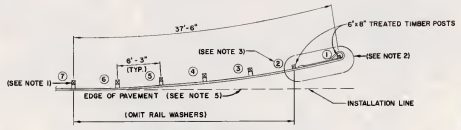
STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90

DWG. NO. 88

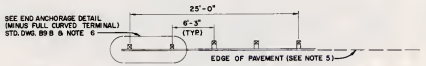
GUARDRAIL FOR GRADE CROSSING PROTECTION

REVISED	4/1/79	JUNE 1983	APR. 1985	BY
EFFECTIVE	6/1/79	9/1/84	8/1/85	ADMINISTRATOR – ENGINEERING DIVISION



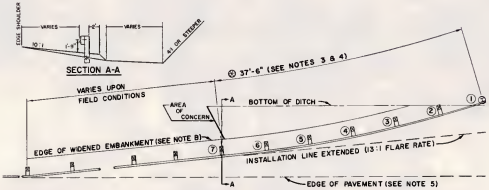
TERMINAL SECTION 1

(TO BE USED ON ALL APPROACH ENDS AND ON ALL TWO LANE, TWO WAY DEPARTURE ENDS)



TERMINAL SECTION 2

(TO BE USED ON FOUR-LANE DIVIDED DEPARTURE ENDS)



TERMINAL SECTION 3

(TO BE USED FOR OUT SLOPE EMBEDMENT)

(8) PARABOLIC SECTION SHALL NOT BE USED WITHIN THE CLEAR ZONE AS DETERMINED BY AASHTO TRAFFIC BARRIER GUIDE.

SEE PLANS FOR BEGINNING AND ENDING STATIONS OF TERMINAL SECTION.

ALL COSTS INVOLVED IN CONSTRUCTING THIS SECTION (INCLUDING BURIED ANCHOR) SHALL BE PAID FOR AT THE UNIT PRICE BID FOR GUARDRAIL.

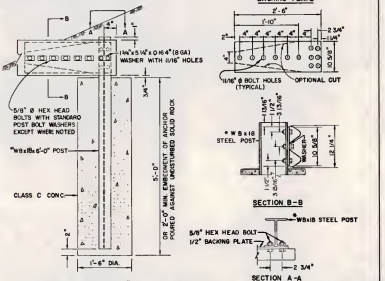
NOTES:

1. 6"x 8" POSTS AND BLOCKS (SEE STD.DWG. NO. 85A).
2. SEE END ANCHOR DETAIL (STD. DWG. NO. 89B) & NOTE 6.
3. PARABOLIC OFFSET DISTANCES:

POST NO.	(7)	(6)	(5)	(4)	(3)	(2)	(1)
OFFSET DISTANCE	0.00'	0.11'	0.44'	1.00'	1.78'	2.78'	4.00'

4. BURIED TERMINAL MAY BE OFFSET BY A FLARE RATE OR BY A FLARE RATE + THE 37'-6" PARABOLIC. IF A PARABOLIC IS USED, ALL OFFSETS ARE FROM THE INSTALLATION LINE EXTENDED.
5. IF FINISHED ROADWAY WIDTH IS LESS THAN 28', TWO FEET OF WIDENING IS REQUIRED.
6. NO PLATE WASHERS TO BE INSTALLED BETWEEN RAIL & BOLTHEAD OF POST BOLT ON POSTS 2 THRU 7 OF TERMINAL SECTIONS, EXCEPT ON TERMINAL SECTION NO.2.
7. ROADSIDE SLOPE FLATTENING FOR TERMINAL SECTIONS:

8. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.
9. BURIED GUARD RAIL ANCHOR DETAIL:



10. TERMINAL RAIL SECTION AND W8x18 TO BE FABRICATED TO RECEIVE 5/8" HEX HEAD BOLTS AS SHOWN. ALL BOLTS SHALL CONFORM TO ASTM DESIGNATION A 325 + OR NEW W8x18 PER ASTM A6-77b.

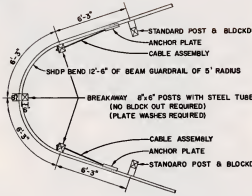
STANDARD DRAWING

REFERENCE:	DWG. NO.
STANDARD SPEC. SECTION 90	89A

GUARDRAIL
TERMINAL SECTIONS

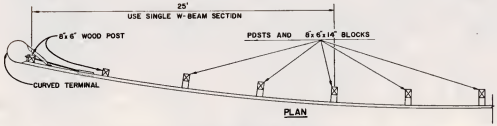
REVISED	NEW
EFFECTIVE	8/1/85

APPROVED BY: [signature]
ADMINISTRATOR - ENGINEERING DIVISION



PLAN

(SEE END ANCHORAGE DETAILS)



PLAN

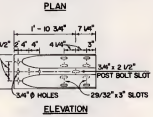
ELEVATION

NO PLATE WASHERS TO BE INSTALLED BETWEEN RAIL & BOLT HEAD OF POST BOLT ON FIRST SEVEN POSTS OF TERMINAL SECTION.

GUARDRAIL END ANCHORAGE – 5' RADIUS

PAYMENT AT THE UNIT PRICE BID FOR "GUARDRAIL-END ANCHORAGE - 5 FT. RADIUS" SHALL BE FULL COMPENSATION FOR FURNISHING ALL MATERIALS (EXCLUSIVE OF BEAM GUARDRAIL AND POSTS) AND WORK NECESSARY TO CONSTRUCT THE END ANCHORAGE REQUIRED TO COMPLETE THE NOSE SECTION DETAILED HEREON.

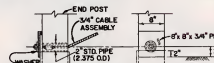
PLAN



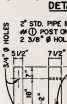
ELEVATION

MICHIGAN END SHOE (ID GAGE)

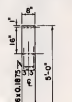
(□) HOLES NOT REQUIRED BUT ACCEPTABLE. ONE INCH WASHERS REQUIRED IN CONNECTION OF MICHIGAN END SHOE & TERMINAL ELEMENT.



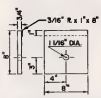
DETAIL A



WOOD BREAKWAY POST



STEEL TUBE



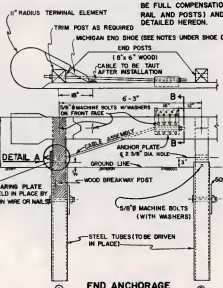
BEARING PLATE DETAILS

NOTES

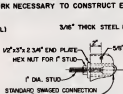
Bolts shall be 1/8" ø smaller than hole and shall be ASTM A-325 or expansion anchor type with washers approved by the Engineer.

GUARDRAIL END ANCHORAGE-STANDARD

PAYMENT AT THE UNIT PRICE BID FOR "GUARDRAIL-END ANCHORAGE- STANDARD" SHALL BE FULL COMPENSATION FOR FURNISHING ALL MATERIALS (EXCLUSIVE OF BEAM GUARDRAIL AND POSTS) AND WORK NECESSARY TO CONSTRUCT EACH END ANCHORAGE AS DETAILED HEREON.


11" RADIUS TERMINAL ELEMENT
TRIM POST AS REQUIRED
MICHIGAN END SHOE (SEE NOTES UNDER SHOE DETAIL)
END POSTS (8'x 6" WOOD)
CABLE TO BE TAUT AFTER INSTALLATION
6'-3"
B
3/4" ø MACHINE BOLTS W/WASHERS ON FRONT FACE
DETAIL A
ANCHOR PLATE-1" x 3/4" DIA. HOLE
GROUND LINE
WOOD BREAKWAY POST
BEARING PLATE (HELD IN PLACE BY THIN WIRE OR NAILS)
SOIL PLATE
5/8" ø MACHINE BOLTS (WITH WASHERS)
STEEL TUBES (TO BE DRIVEN IN PLACE)
①
②

END ANCHORAGE

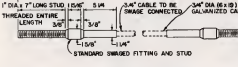

3/16" THICK STEEL PLATE
HEX NUT FOR 5/8" BOLT
1/2"x3"x 2 3/4" END PLATE
HEX NUT FOR 1" STUD
5/8" BOLT
1" DIA. STUD
STANDARD SWAGED CONNECTION FOR 3/4" CABLE
3/4" MACHINE BOLT AND CUT WASHER ON FRONT FACE AT NEUTRAL AXIS OF RAIL
NEUTRAL AXIS
FOR 5/8" BOLT ON NEUTRAL AXIS
METAL BEAM GUARD RAIL

SECTION B-B
(END PLATE REMOVED)

ANCHOR PLATE DETAILS

SOIL PLATE

END PLATE



CABLE ASSEMBLY

REVISED / EFFECTIVE	NEW			
	8/1/85			

STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90

DWG. NO. 898

GUARDRAIL END ANCHORAGE

APPROVED BY

ADMINISTRATOR - ENGINEERING DIVISION

REVISIONS
To

MONTANA DEPARTMENT OF HIGHWAYS

STANDARD DRAWINGS

1984 Edition

Effective August 1, 1985

STATE OF MONTANA
DEPARTMENT OF HIGHWAYS

NOTICE CONCERNING REVISIONS TO THE
1984 EDITION OF THE STANDARD DRAWINGS

The following are revised and new drawings, together with revised page 4 of the Table of Contents, to be added to the Standard Drawing Book you now have. These drawings affect those projects let to contract after August 1, 1985.

Std. Dwg. No. 85A - Metal Guardrail
85B - Metal Median Rail
87A - Guardrail Installation for Median Hazards
87B - Guardrail Installation for Median & Outside Shoulder Hazards
88 - Guardrail for Grade Crossing Protection
89A - Guardrail Terminal Sections
89B - Guardrail End Anchorage

Users of these Standard Drawings are advised to examine carefully each drawing. The following are "some" of the more significant changes involved and do not necessarily refer to all changes made on a particular drawing.

Std. Dwgs., Nos. 85A & 85B
A note pertaining to tacking of the blocks was added to each drawing. Dwg. No. 85A also contains changes to the details shown for "Section A-A" and "Bitum. Curb With Guardrail."

Std. Dwgs., Nos. 87A & 87B
These are new drawings and replace current Std. Dwg. No. 87.

Std. Dwg. No. 88
Changes were made in the Terminal Sections called for in the PLAN view. The note in the bottom right hand corner was also revised.

Std. Dwg. No. 89A
This drawing was revised completely. Terminal Section 1 is now only 37.5 feet long using a parabolic curve with a 4 foot offset in lieu of the previous 75.0 feet tangent section with an 8.5 foot offset. Previous Terminal Section A has been deleted. Terminal Section 3 (previous 6) for placement into the cut slope is a complete new design.

Std. Dwg. No. 89B
This drawing was revised completely. Principal design changes were the addition of the detail for the "Guardrail End Anchorage - 5 Ft. Radius" and distinguishing between it and the "Guardrail End Anchorage - Standard." The format was revised for clarity.

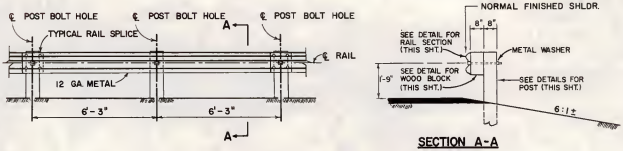
D Budd Williams
for J. V. O'Donnell, Supervisor
Contract Plans Section

JVO'D:DBW:cg:1Z

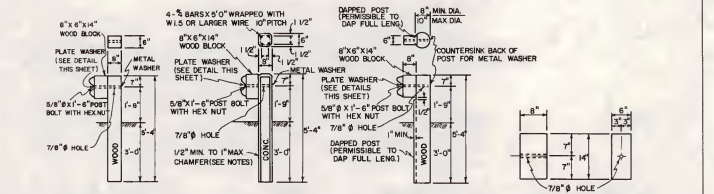
FENCE AND CATTLE GUARD (cont.)			
Farm Fence	78	6/1/79	81
Cattle Guard	79	4/1/84	82
Precast Concrete Base for Cattleguard	80	6/1/79	82
GUARDRAIL			
Concrete Median Rail	84	4/1/84	90
Metal Guardrail	85A	8/1/85	90
Metal Median Rail	85B	8/1/85	90
Bridge Approach Sections	86	4/1/84	90
Guardrail Installation for Median Hazards	87A	8/1/85	90
Guardrail Installation for Median & Outside Shoulder Hazards	87B	8/1/85	90
Guardrail for Grade Crossing Protection	88	8/1/85	90
Guardrail Terminal Sections	89A	8/1/85	90
End Anchorage	89B	8/1/85	90
Cable Guardrail	90	3/1/72	90
Cable Guardrail Driveway Anchor Section	91	3/1/72	90
MISCELLANEOUS STANDARDS			
Slope Rounding	100	3/1/72	11
Roadway Embankment at Bridge End	101	3/1/72	11
U-Turn Median Openings on Controlled Access Highways	102	3/1/72	11
Approaches	103	3/1/72	20

Effective Aug. 1, 1985

2'0" WIDENING IS REQUIRED IF FINISHED ROADWAY WIDTH IS LESS THAN 28'



SECTION A-A



SQUARE WOOD POST (S4S OR ROUGH)

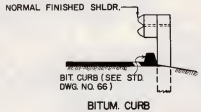
CONCRETE POST

ROUND WOOD POST

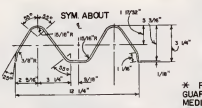
8"X6"X14" WOOD BLOCK (S4S OR ROUGH)

DETAIL OF GUARD RAIL POSTS

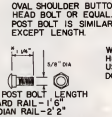
2'0" WIDENING IS REQUIRED IF FINISHED ROADWAY WIDTH IS LESS THAN 28'



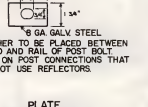
BITUM. CURB WITH GUARD RAIL



RAIL SECTION

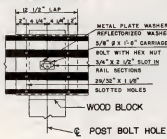

OVAL SHOULDER BUTTON HEAD BOLT OR EQUAL. POST BOLT IS SIMILAR EXCEPT LENGTH.
5/8" DIA
* POST BOLT LENGTH
GUARD RAIL - 1'6"
MEDIAN RAIL - 2'2"

SPLICE BOLT & NUT



WASHER TO BE PLACED BETWEEN HEAD AND RAIL OF POST BOLT. USE ON POST CONNECTIONS THAT DO NOT USE REFLECTORS.

PLATE WASHER DETAIL


12 1/2" - 14"
2'-4 1/8" - 4 1/4" - 2'-4"
METAL PLATE WASHER OR REFLECTORIZED WASHER
⅝" Ø x 1'-6" CARRIAGE BOLT WITH HEX NUT
¼" X 2 1/2" SLOT IN RAIL SECTIONS
29/32" X 1 1/8" SLOTTED HOLES
WOOD BLOCK
℄ POST BOLT HOLE

RAIL SPLICE DETAIL
(LAP IN DIRECTION OF TRAFFIC)

MATERIAL SIZES

MATERIAL MEETING FORMER STD. DWG. REQUIREMENTS IS ACCEPTABLE PROVIDING IT IS USED ON TOTAL PROJECT.

NOTES

RAIL: GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 525 OR ASTM A 123. STEEL RAIL SHALL CONFORM TO ASSHTO M180. ALL RAIL PLATES ARE TO BE LAPPED IN DIRECTION OF TRAFFIC.

POSTS: ROUND POSTS SHALL HAVE NO DIAMETER LESS THAN 8" OR MORE THAN 10" ONLY ONE TYPE POST (SQUARE OR ROUND) TO BE USED WITHIN ONE PROJECT.

TERMINAL SECTIONS: SEE STANDARD DRAWING NO. 89A FOR APPROACH AND DEPARTURE TERMINAL SECTIONS.

BRIDGE APPROACH: SEE STANDARD DRAWING NO. 86 FOR TREATMENT AT BRIDGE ENDS

REFLECTOR-WASHER: ALL SECTIONS OF GUARD RAIL SHALL HAVE REFLECTOR WASHERS SPACED EVERY 25 FT. REFLECTOR WASHERS TO BE INCLUDED IN THE UNIT PRICE PER LINEAR FOOT OF GUARD RAIL. SEE DETAIL ON STANDARD DRAWING NO. 85 B.

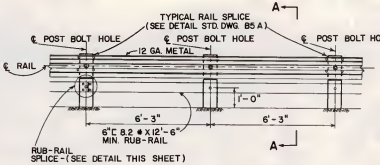
FITTINGS: ALL FITTINGS SHALL BE GALVANIZED TO CONFORM WITH STANDARD SPEC. M-220(I)

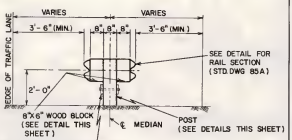
CONCRETE POSTS: ONLY ONE SIZE CHAMFER CAN BE USED IN A SINGLE RUN OF RAIL.

BLOCKS: TO PREVENT TWISTING, BLOCKS SHALL BE AFFIXED TO THE POSTS BY USE OF A NAIL, WIRE, ADHESIVE, OR OTHER MEANS MEETING THE APPROVAL OF THE ENGINEER.

STANDARD DRAWING	
REFERENCE: STANDARD SPEC. SECTION 90	DWG. NO. 85 A
METAL GUARD RAIL	

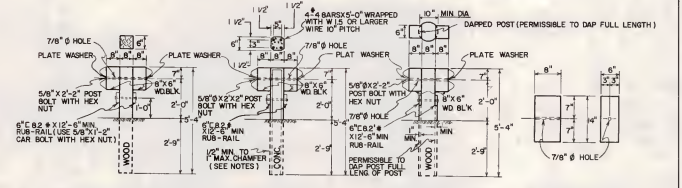
REVISED	NEW	MAY 1985		APPROVED BY: Ben M. Harrison
EFFECTIVE	4/1/04			ADMINISTRATOR-ENGINEERING DIVISION





NOTE: FOR DETAIL OF RUB-RAIL SEE POSTS BELOW

SECTION A-A



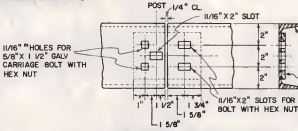
SQUARE WOOD POST (S4S OR ROUGH)

CONCRETE POST

ROUND WOOD POST

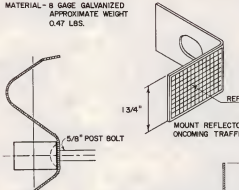
WOOD BLOCK DETAIL (S4S OR ROUGH)

DETAIL OF GUARD RAIL POSTS



DETAIL OF RUB RAIL SPLICE

(RAIL SPLICE TO OCCUR AT POSTS ONLY)



REFLECTOR-WASHER

SEE STANDARD DRAWING NO. 85A

FOR: RAIL SECTION DETAIL
SPLICE BOLT & NUT DETAIL
RAIL SPLICE DETAIL
PLATE WASHER DETAIL

NOTES

RAIL: GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 525 OR ASTM A 123. STEEL RAIL SHALL CONFORM TO AASHTO M180. ALL RAIL PLATES ARE TO BE LAPPED IN DIRECTION OF TRAFFIC.

POSTS: ROUND POSTS SHALL HAVE NO DIAMETER LESS THAN 8" OR MORE THAN 10" ONLY ONE TYPE POST (SQUARE OR ROUND) TO BE USED WITHIN ONE PROJECT.

REFLECTOR-WASHER: ALL SECTIONS OF MEDIAN RAIL SHALL HAVE REFLECTOR WASHERS SPACED EVERY 25 FT. REFLECTOR WASHERS TO BE INCLUDED IN THE UNIT PRICE PER LINEAR FOOT OF MEDIAN RAIL. SEE DETAIL THIS SHEET.

FITTINGS: ALL FITTINGS SHALL BE GALVANIZED TO CONFORM WITH STANDARD SPEC. M - 220.01

CONCRETE POSTS: ONLY ONE SIZE CHAMFER CAN BE USED IN A SINGLE RUN OF RAIL.

BLOCKS: TO PREVENT TWISTING, BLOCKS SHALL BE AFFIXED TO THE POSTS BY USE OF A NAIL, WIRE, ADHESIVE, OR OTHER MEANS MEETING THE APPROVAL OF THE ENGINEER.

MATERIAL SIZES

MATERIAL MEETING FORMER STD. DWG. REQUIREMENTS IS ACCEPTABLE PROVIDING IT IS USED ON TOTAL PROJECT.

STANDARD DRAWING

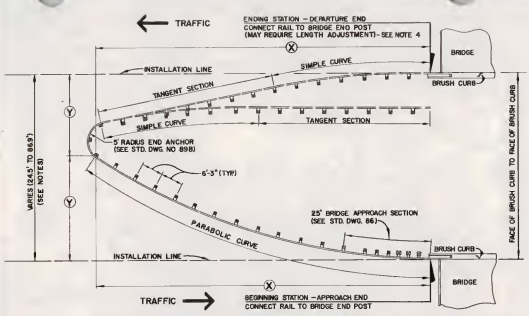
REFERENCE: STANDARD SPEC. SECTION 90

DWG. NO. 85 B

METAL MEDIAN RAIL

REVISED	NEW	MAY 1985
EFFECTIVE	4/1/84	8/1/85

APPROVED
BY Jim M. Kenneth
ADMINISTRATOR - ENGINEERING DIVISION



(X) IS THE DISTANCE ALONG THE INSTALLATON LINE FROM THE BEGINNING OR ENDING STATION TO A POST LOCATION.

(Y) IS THE OFFSET FROM INSTALLATION LINE TO THE FACE OF RAIL.

APPROACH SIDE OFFSETS
(FACE OF GUARDRAIL)

DATA	STATION	(X)	(Y)
	0	0	0
	3.25	3.125	0.03
	6.25	6.25	0.11
	9.375	9.37	0.24
	12.5	12.49	0.43
	15.625	15.61	0.67
PARABOLIC (8Y SLOPE)	18.75	18.72	0.96
Δ = 24°50'	25	24.92	1.71
L = 84.39'	31.25	31.10	2.66
T = 41.49'	37.5	37.24	3.82
T2=4.624	43.75	43.34	5.17
	50	49.40	8.73
	56.25	55.40	8.48
	62.5	61.34	10.41
	68.75	67.22	12.53
	75	73.03	14.82
	81.25	78.79	17.28
	87.5	84.46	19.89
	93.75	90.13	22.51
	100	95.81	25.14
	106.25	101.48	27.76
TANGENT EXTENSION (SEE PLANS)	112.5	107.15	30.39
	118.75	112.82	33.01
	125	118.49	35.64
	131.25	124.17	38.26
	137.5	129.84	40.89
	143.75	135.51	43.51
	150	141.18	46.13
	156.25	146.85	48.76
	162.5	152.53	51.38

DEPARTURE SIDE OFFSETS
(FACE OF GUARDRAIL)

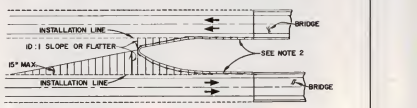
DATA	STATION	(X)	(Y)
NOSE			
Δ = 143°14'30"			
R = 5'			
L = 12.5'			
T = 15.05'			

NOTE:

Refer to plans for tables

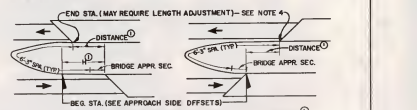
NOTES:

1. SLOPE FLATTENING AND GUARDRAIL LAPPING DETAIL:



2. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.

3. SKEW BRIDGE DETAILS:


END STA. (MAY REQUIRE LENGTH ADJUSTMENT) – SEE NOTE 4
DISTANCE (X)
6'-3" SPA. (TYP)
BRIDGE APPR. SEC.
BEG. STA. (SEE APPROACH SIDE OFFSETS)
DISTANCE (X)
6'-3" SPA. (TYP)
BRIDGE APPR. SEC.

(X) IS THE LOWEST MUTIPLE OF 12.5' WHICH EXCEEDS DISTANCE (D)

4. AN ADDITIONAL TANGENT SECTION OF BEAM GUARDRAIL WILL BE INCLUDED AS THE LOWEST MUTIPLE OF 12.5' WHICH EXCEEDS NET L.N. F.T. GUARDRAIL PER INSTALLATIN.

5. THIS DRAWING IS APPLICABLE FOR PROVIDING GUARDRAIL PROTECTION FROM MEDIAN HAZARDS LOCATED BETWEEN INSTALLATION LINES (SEE DETAIL) OF NOT LESS THAN 24.5' NOR MORE THAN 86.9'.

6. WHEN DISTANCE BETWEEN INSTALLATION LINES EXCEEDS 86.9', USE 300' TANGENT SECTION PLUS TERMINAL SECTION NO 1 (SEE STD. NO. B9 A).

7. WHEN DISTANCE BETWEEN INSTALLATION LINES IS NOT LESS THAN 16.75' NOR MORE THAN 24.5', SEE STD. DWG. NO. B7 B.

8. WHEN DISTANCE BETWEEN INSTALLATION LINES IS LESS THAN 16.75', SEE PLANS FOR SPECIAL TREATMENT.

9. APPROPRIATE ADJUSTMENT IN DESIGN OF INSTALLATION SHALL BE MADE FOR CURVED ROADWAY, SKEWED BRIDGES, OR OTHER CONDITIONS NOT SHOWN. EXACT DETAILS OF THE INSTALLATION SHALL BE DIRECTED BY THE ENGINEER.

APPLICATION CRITERIA

SEE ABOVE NOTES 5,6,7 & 8

STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 30

DWG. NO. B7A

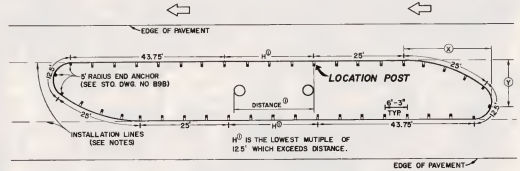
GUARDRAIL INSTALLATION FOR MEDIAN HAZARDS

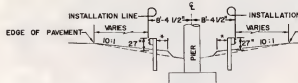
REVISED	NEW			
EFFECTIVE	8/1/85			

APPROVED BY: Don M. Hewitt

ADMINISTRATOR - ENGINEERING DIVISION

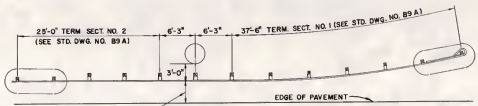
MEDIAN BRIDGE PIER TREATMENT





MEDIAN DETAIL

OUTSIDE SHLDR. BRIDGE PIER TREATMENT



OUTSIDE SHOULDER DETAIL

NOTES:

(APPLICABLE TO MEDIAN HAZARDS)

1. APPROACH SIDE OFFSETS MEDIAN BRIDGE PIER TREATMENT:

CURVE DATA	DISTANCE ALONG CURVE		Ⓧ	Ⓨ
DELTA = 36°45'30" RADIUS = 38.97'	PC	0	0	0
		6.25	6.24	0.50
		12.5	12.29	1.99
		18.75	18.03	4.42
DELTA = 143°14'30" RADIUS = 5'	PCC	25	23.32	7.75
		31.25	25.07	13.33
	PT	37.5	20.33	16.75

Ⓧ IS THE DISTANCE ALONG THE INSTALLATION LINE FROM THE BEGINNING OF GUARDRAIL TO A POST LOCATION.

Ⓨ IS THE OFFSET FROM INSTALLATION LINE TO FACE OF RAIL.

2. MEDIAN SLOPE FLATTENING AND GUARDRAIL LAPPING DETAIL:

3. THIS DRAWING IS APPLICABLE FOR PROVIDING GUARDRAIL PROTECTION FROM MEDIAN HAZARD LOCATED BETWEEN EDGE OF PAVEMENTS(SEE DETAIL) OF NOT LESS THAN 16'-9" NOR MORE THAN 24'-6".

4. SEE STD. DWG. NO. B7A FOR APPLICATIONS NOT MEETING CRITERIA IN NOTE 3.

(APPLICABLE TO OUTSIDE SHOULDER HAZARDS)

5. GUARDRAIL PROTECTION REQUIRED ONLY WHEN NEAREST OBSTRUCTION IS LESS THAN 30 FEET FROM EDGE OF NEAREST TRAFFIC LANE.

(APPLICABLE TO BOTH APPLICATIONS)

6. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE OUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED - SEE PLANS.

7. APPROPRIATE ADJUSTMENT IN DESIGN OF INSTALLATION SHALL BE MADE FOR CURVED ROADWAY OR OTHER CONDITIONS NOT SHOWN. EXACT DETAILS OF THE INSTALLATION SHALL BE AS DIRECTED BY ENGINEER.

APPLICATION CRITERIA

SEE ABOVE NOTES 3 & 4

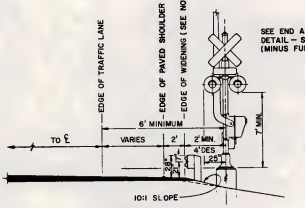
STANDARD DRAWING

REFERENCE: STANDARD SPEC. SECTION 90 — DWG. NO. 878

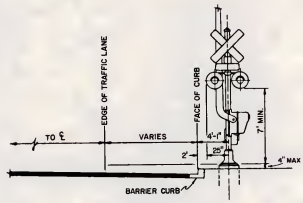
GUARDRAIL INSTALLATION FOR MEDIAN AND OUTSIDE SHOULDER HAZARDS

REVISED	NEW	
EFFECTIVE	9-1-87	

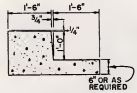
APPROVED BY: Bruce Harrell
ADMINISTRATOR - ENGINEERING DIVISION



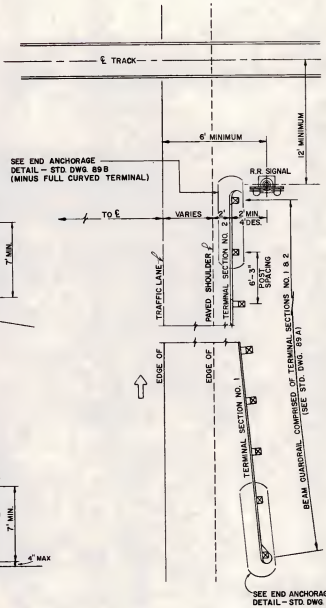
ELEVATION



ELEVATION



TYPICAL BARRIER CURB



PLAN

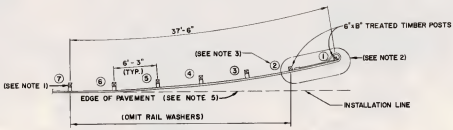
SEE 8C-1 OF MANUAL ON UNIFORM TRAFFIC CONTROL FOR ADDITIONAL DETAILS & SKEWED CROSSING.

WIDENING IS NOT REQUIRED IF FINISHED ROADWAY IS MINIMUM 28'.

STANDARD DRAWING	
REFERENCE: STANDARD SPEC. SECTION 90	DWG. NO. 88
GUARDRAIL FOR GRADE CROSSING PROTECTION	

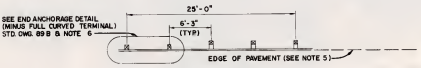
REVISED	4/1/79	JUNE 1983	APR. 1985
EFFECTIVE	6/1/79	4/1/84	8/1/85

BY _____
ADMINISTRATOR-ENGINEERING DIVISION



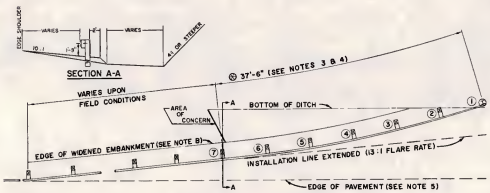
TERMINAL SECTION 1

(TO BE USED ON ALL APPROACH ENDS AND ON ALL TWO LANE, TWO WAY DEPARTURE ENDS)



TERMINAL SECTION 2

(TO BE USED ON FOUR-LANE DIVIDED DEPARTURE ENDS)



TERMINAL SECTION 3

(TO BE USED FOR OUT SLOPE EMBEDMENT)

Ⓧ PARABOLIC SECTION SHALL NOT BE USED WITHIN THE CLEAR ZONE AS DETERMINED BY AASHTO TRAFFIC BARRIER GUIDE.

SEE PLANS FOR BEGINNING AND ENDING STATIONS OF TERMINAL SECTION.

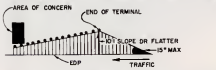
ALL COSTS INVOLVED IN CONSTRUCTING THIS SECTION (INCLUDING BURIED ANCHOR) SHALL BE PAID FOR AT THE UNIT PRICE BID FOR GUARDRAIL.

NOTES:

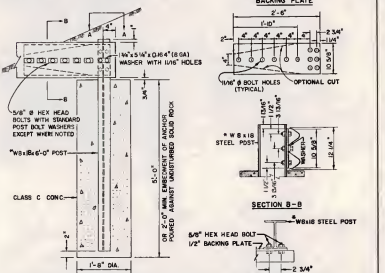
1. 6"x8" POSTS AND BLOCKS (SEE STD.DWG. NO. 85A).
2. SEE END ANCHOR DETAIL (STD. DWG. NO. 89B) & NOTE 6.
3. PARABOLIC OFFSET DISTANCES:

POST NO.	⑦	⑥	⑤	④	③	②	①
OFFSET DISTANCE	0.00'	0.11'	0.44'	1.00'	1.78'	2.78'	4.00'

4. BURIED TERMINAL MAY BE OFFSET BY A FLARE RATE OR BY A FLARE RATE + THE 37'-6" PARABOLIC. IF A PARABOLIC IS USED, ALL OFFSETS ARE FROM THE INSTALLATION LINE EXTENDED.
5. IF FINISHED ROADWAY WIDTH IS LESS THAN 28', TWO FEET OF WIDENING IS REQUIRED.
6. NO PLATE WASHERS TO BE INSTALLED BETWEEN RAIL & BOLTHEAD OF POST BOLT ON POSTS 2 THRU 7 OF TERMINAL SECTIONS, EXCEPT ON TERMINAL SECTION NO.2.
7. ROADSIDE SLOPE FLATTENING FOR TERMINAL SECTIONS:



8. THE 10:1 SLOPE FLATTENING SHALL EXTEND TWO FEET FROM BACK OF POST WHENEVER INSLOPES ARE STEEPER THAN 6:1. SHOULD FLATTENING BE IMPRACTICABLE DUE TO INSLOPES BEING TOO STEEP, LONGER POSTS SHALL BE PROVIDED – SEE PLANS.
9. BURIED GUARD RAIL ANCHOR DETAIL:

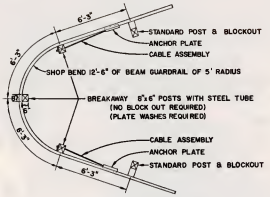


10. TERMINAL RAIL SECTION AND *W6x15 TO BE FABRICATED TO RECEIVE 5/8" HEX HEAD BOLTS AS SHOWN. ALL BOLTS SHALL CONFORM TO ASTM DESIGNATION A 325 * OR NEW W6x15 PER ASTM A6-77b.

STANDARD DRAWING	
REFERENCE: STANDARD SPEC. SECTION 90	DWG. NO. 89A

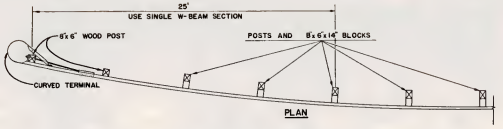
GUARDRAIL
TERMINAL SECTIONS

REVISED	NEW		APPROVED BY: [signature]
EFFECTIVE	8/1/85		ADMINISTRATOR - ENGINEERING DIVISION



PLAN

(SEE END ANCHORAGE DETAILS)



PLAN

ELEVATION

NO PLATE WASHERS TO BE INSTALLED BETWEEN RAIL & BOLT HEAD OF POST BOLT ON FIRST SEVEN POSTS OF TERMINAL SECTION.

GUARDRAIL END ANCHORAGE - 5' RADIUS

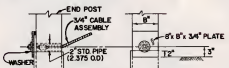
PAYMENT AT THE UNIT PRICE BID FOR "GUARDRAIL- END ANCHORAGE - 5 FT. RADIUS" SHALL BE FULL COMPENSATION FOR FURNISHING ALL MATERIALS (EXCLUSIVE OF BEAM GUARDRAIL AND POSTS) AND WORK NECESSARY TO CONSTRUCT THE END ANCHORAGE REQUIRED TO COMPLETE THE NOSE SECTION DETAILED HEREON.

PLAN

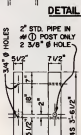
ELEVATION

MICHIGAN END SHOE (10 GAGE)

HOLES NOT REQUIRED BUT ACCEPTABLE. ONE INCH WASHERS REQUIRED IN CONNECTION OF MICHIGAN END SHOE & TERMINAL ELEMENT.



DETAIL A



WOOD BREAKWAY POST

STEEL TUBE

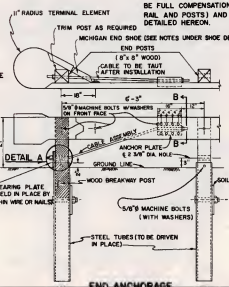
BEARING PLATE DETAILS

NOTES

Bolts shall be 1/8" ø smaller than hole and shall be ASTM A-325 or expansion anchor type with washers approved by the Engineer.

GUARDRAIL END ANCHORAGE - STANDARD

PAYMENT AT THE UNIT PRICE BID FOR "GUARDRAIL - END ANCHORAGE - STANDARD" SHALL BE FULL COMPENSATION FOR FURNISHING ALL MATERIALS (EXCLUSIVE OF BEAM GUARDRAIL AND POSTS) AND WORK NECESSARY TO CONSTRUCT EACH END ANCHORAGE AS DETAILED HEREON.


1" RADIUS TERMINAL ELEMENT
TRIM POST AS REQUIRED
MICHIGAN END SHOE (SEE NOTES UNDER SHOE DETAIL)
END POSTS (8"x 8" WOOD)
CABLE TO BE TAUT AFTER INSTALLATION
6'-3"
18"
B
5/8" ø MACHINE BOLTS W/WASHERS ON FRONT FACE
3"
3"
3"
3"
3"
3"
CABLE
SIDE PANEL
ANCHOR PLATE
6 3/4" DIA. HOLE
B
DETAIL A
GROUND LINE
WOOD BREAKWAY POST
SOIL PLATE
BEARING PLATE (HELD IN PLACE BY THIN WIRE OR NAILS)
5/8" ø MACHINE BOLTS (WITH WASHERS)
STEEL TUBES (TO BE DRIVEN IN PLACE)
1'-3"
1'-3"
1'-3"